CUBEscan

BioCon-500™
Bladder Volume Measurement System

Service Manual

Man, Machine & Medicine
Mcube Technology Co., Ltd.

CUBEscan BioCon-500 Service Manual

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This service manual contains technical contents for service as below.

- **Product configuration**
  - Product configuration and block diagram
  - Product components and their functions
  - Signal interface and their definition
- **Structure and assembling of the device**
  - Structure and components
  - Assembling sequence
- **Signal test**
- **Troubleshooting**

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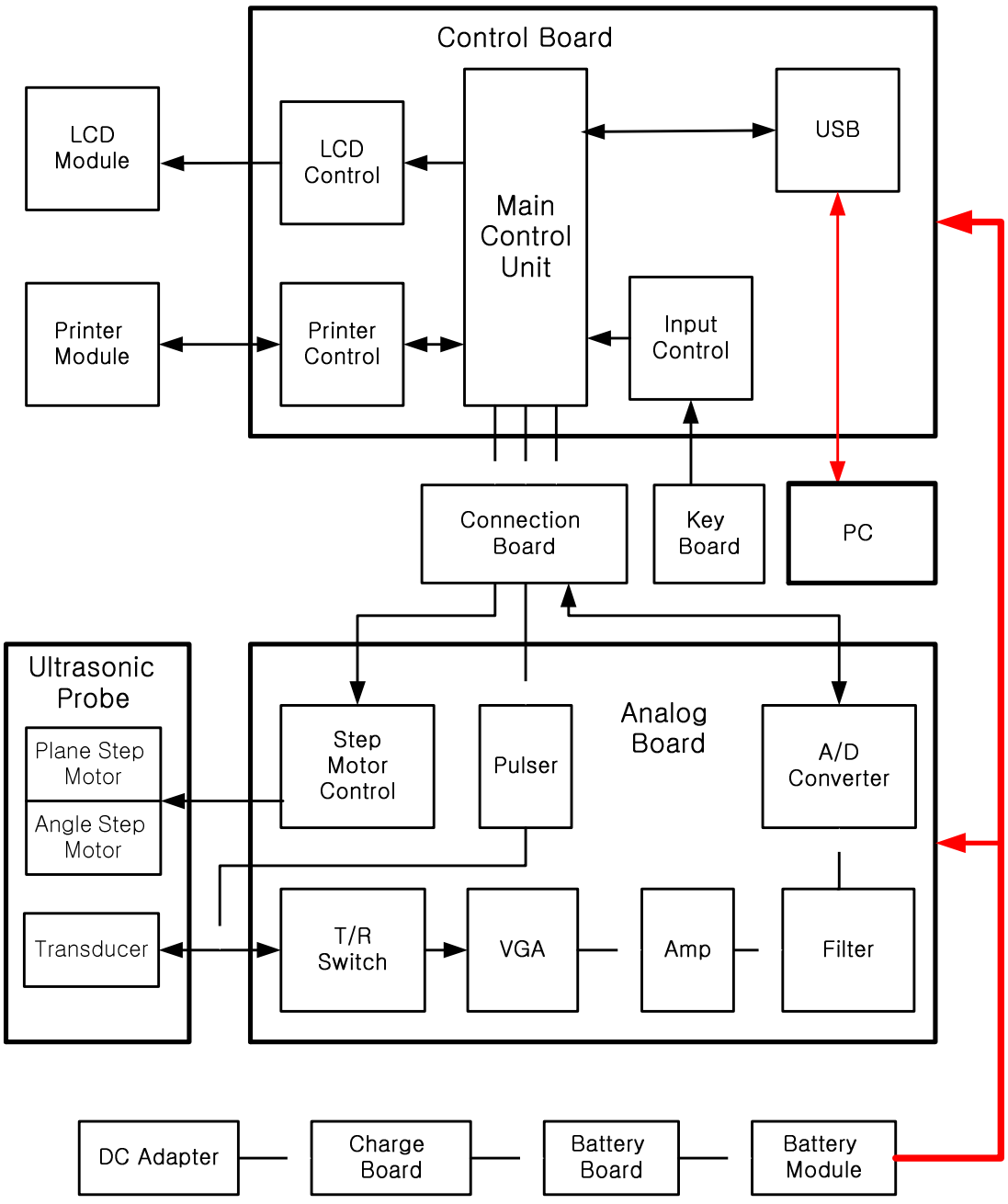
1. Product Configuration

1.1 Maintenance Mode Password

BioCon-500 has two system modes. One is Normal mode, and the other is Maintenance mode. Normal mode is for the normal user, and Maintenance mode is for the technicians in the hospital or service engineers. To enter the maintenance mode, push LEFT key with ENTER key being pushed and then push PRINT key after the system is turned on and the top screen is displayed in normal mode. When you press 'ENTER+LEFT+PRINT' keys, the BioCon-500 asks for the Maintenance mode password (after the firmware version 3.1.009). **Input '1122' for the password.** You cannot change the password.

1.2 Product Configuration

BioCon-500™ is a 3-dimensional ultrasonic equipment to measure the bladder volume and quantity of remaining urine safely and comfortably through non-invasive method. Its overall structure is as below.



The system, in large, consists of a console, an ultrasonic probe, and a DC adapter

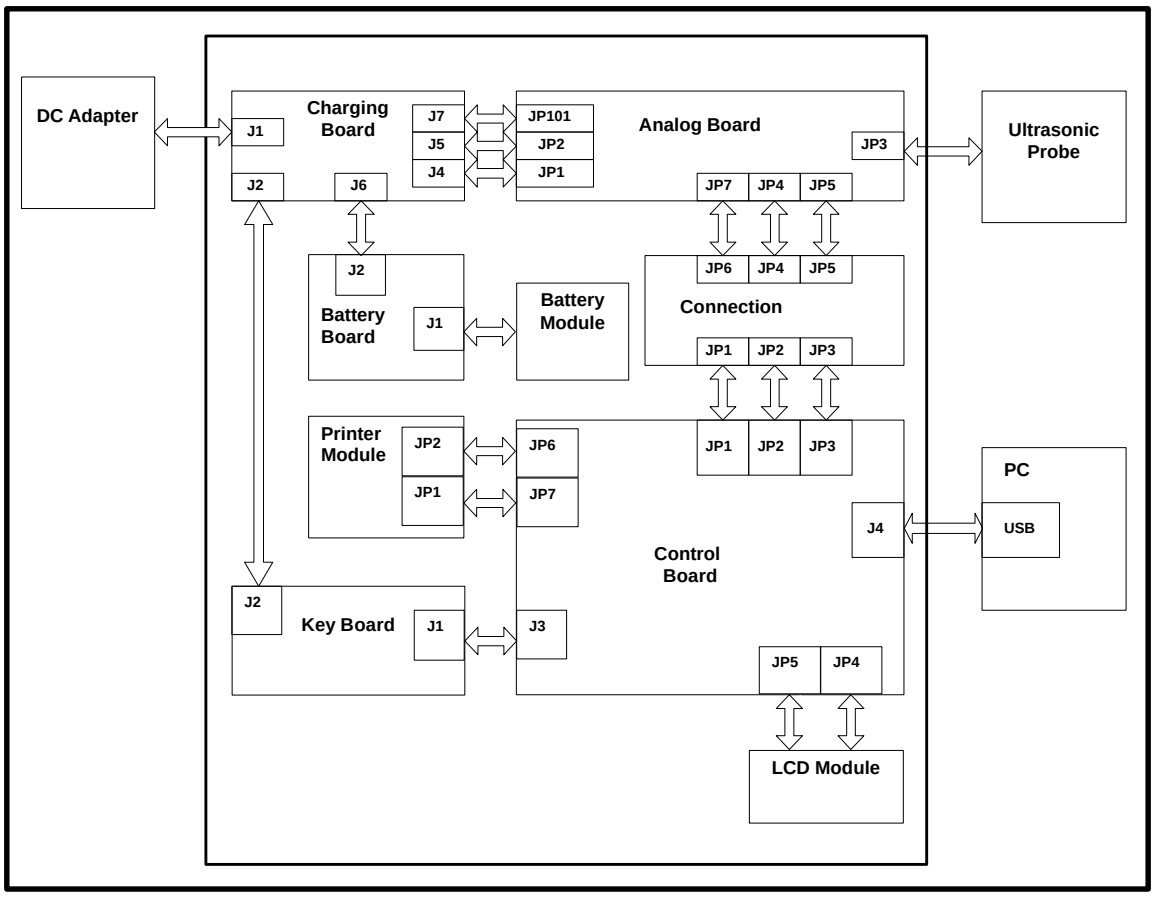
Component	Function
DC Adapter	Supplies a DC power required in the Charge Board for charging at the system.
Console	Controls system operation and various signals, and handles signal transmission and reception.
Ultrasonic Probe	Transmits and receives the ultrasonic signals, being used in close contact with the patient.

The Console consists of a printer module, a LCD module, a battery module, and a number of boards. Its functions are as below.

Component	Function
Charge Board	Charges the battery module with DC 16V input from a DC adapter.
Battery Board	Connects the Charge Board and the Battery Module.
Analog Board	Transmits an ultrasonic pulse to the ultrasonic probe, processes the signal just received, and transmits the data transferred through the A/D converter to the control board. It also drives the stepping motors required in imaging.
Connection Board	Input from a user.
Key Board	Performs interfacing between the users and the system.
Control Board	Controls the overall system with following major functions. - Processes user's input. - Drives the stepping motor of the thermal printer and transmits data - Controls the charging of a battery module - Interfaces PC through USB. - Displays data on LCD - Processes data received from the Analog Board
Battery Module	Provides the power required in the system.
LCD Module	Displays various information.
Printer Module	Prints the information about the bladder and bladder images on the thermal paper

1.3 Signal Interface

The signal interface for the system is as below.



(Structure of Signal Interface at BioCon-500)

1.3.1 Signal Interface of the Control Board

JP1 is a connector to exchange the data with ADC (Analog-Digital Converter) in the Analog Board. And each signal is defined as below.

JP1			
TO:	**Analog Board Connection**		
Pin No.	**Name**	**I/O**	**Description**
1	FH_DB0	In	AD Conversion Data In bit 0
2	FH_DB1	In	AD Conversion Data In bit 1
3	FH_DB2	In	AD Conversion Data In bit 2
4	FH_DB3	In	AD Conversion Data In bit 3
5	FH_DB4	In	AD Conversion Data In bit 4
6	FH_DB5	In	AD Conversion Data In bit 5
7	FH_DB6	In	AD Conversion Data In bit 6
8	FH_DB7	In	AD Conversion Data In bit 7
9	FH_DB8	In	AD Conversion Data In bit 8
10	FH_DB9	In	AD Conversion Data In bit 9
11	FH_DB10	In	AD Conversion Data In bit 10
12	FH_DB11	In	AD Conversion Data In bit 11
13	FH_BLANK	Out	Blank signal
14	FH_AD_CS	Out	ADC chip select
15	FH_AD_RD	Out	ADC Read
16	FH_CONVST	Out	ADC Conversion Start
17	FH_AD_CLK	Out	ADC clock
18	FH_AD_BUSY	In	ADC busy
19	FH_POS_PULSE	Out	To generate positive pulse
20	PH_NEG_PULSE	Out	To generate negative pulse

JP2 is a connector representing a power from the analog board and other various signals. And each signal is defined as belows.

JP2			
To:	**Analog Board Connection**		
Pin No.	**Name**	**I/O**	**Description**
1	H_BAT_UNSWITCHED	Power	Input power from analog board
2	H_BAT_UNSWITCHED	Power	Input power from analog board
3	H_BAT_UNSWITCHED	Power	Input power from analog board
4	H_BAT_UNSWITCHED	Power	Input power from analog board
5	SWITCHING_ON	Out	To say that control board is on.
6	-	-	Reserved
7	-	-	Reserved
8	-	-	Reserved
9	-	-	Reserved
10	-	-	Reserved
11	-	-	Reserved
12	-	-	Reserved
13	VDD	Power	ADC digital logic power
14	VDD	Power	ADC digital logic power
15	Ground	Power	Ground signal
16	Ground	Power	Ground signal
17	Ground	Power	Ground signal
18	CH_AN_PWR_ON	Out	Analog board power on/off
19	CH_SCLK	in	Probe detection signal
20	FH_SCAN_SW	In	Probe scan switch input

JP3 is a connector to exchange the data with the stepping motor built in the ultrasonic probe. And each signal is defined as below.

JP3			
To:	**Analog Board Connection**		
Pin No.	**Name**	**I/O**	**Description**
1	FH_MOT_CON1	Out	Probe motor driver control signal
2	FH_MOT_CON2	Out	Probe motor driver control signal
3	FH_MOT_CON3	Out	Probe motor driver control signal
4	FH_MOT_CON4	Out	Probe motor driver control signal
5	FH_MOT_CON5	Out	Probe motor driver control signal
6	FH_MOT_CON6	Out	Probe motor driver control signal
7	FH_MOT_CON7	Out	Probe motor driver control signal
8	FH_MOT_CON8	Out	Probe motor driver control signal
9	FH_MOT_CON9	Out	Probe motor driver control signal
10	FH_MOT_CON10	Out	Probe motor driver control signal
11	FH_MOT_CON11	Out	Probe motor driver control signal
12	FH_MOT_CON12	Out	Probe motor driver control signal
13	FH_MOT_CON13	Out	Probe motor driver control signal
14	FH_MOT_CON14	Out	Probe motor driver control signal
15	FH_MOT_CON15	Out	Probe motor driver control signal
16	FH_MOT_CON16	Out	Probe motor driver control signal
17	CH_MOT_PWR_ON	Out	Probe motor power on/off
18	H_PROBE_PWR	Power	Power for motor driving
19	H_PROBE_PWR	Power	Power for motor driving
20	Ground	Power	Ground signal

JP4 is a connector to provide a driving power required in LCD backlight. And each signal is defined as below.

JP4			
TO:	**LCD Backlight**		
Pin No.	**Name**	**I/O**	**Description**
1	High	Out	AC high voltage
2	-	-	Not used
3	-	-	Not used
4	Low	Out	Ground

JP5 is a connector related to an LCD display and connected to an LCD module. And each signal is defined as below.

JP5			
TO:	**LCD Module**		
Pin No.	**Name**	**I/O**	**Description**
1	VD0	Out	Display data signal
2	VD1	Out	Display data signal
3	VD2	Out	Display data signal
4	VD3	Out	Display data signal
5	VM	Out	Display on/off signal
6	VFRAME	Out	Scan start-up signal
7	-	-	Not used
8	VLINE	Out	Data input latch signal
9	VCLK	Out	Data input clock signal
10	VCC	Power	Power supply for logic(+5V)
11	Ground	Power	Ground signal
12	VEE	Power	Power supply for LCD
13	VO	Power	LCD contrast adjust voltage
14	Ground	Power	Ground signal

JP6 and JP7, the connector terminals for the connection with the printer module, are connectors for the driving of a stepping motor built in the printer module, for data latch, for data I/O, and for power. And each signal is defined as below

JP6			
TO:	**Printer Module**		
Pin No.	**Name**	**I/O**	**Description**
1	FP_STROBE3	Out	Third strobe
2	FP_STROBE2	Out	Second strobe
3	FP_STROBE1	Out	First strobe
4	VP_LOGIC	Power	Logic voltage
5	FP_PRI_CLK	Out	Serial clock
6	FP_LATCH	Out	Latch
7	FP_PRI_DATA_IN	IN	Data input
8	PRT_PWR	Power	Dot-line voltage
9	PRT_PWR	Power	Dot-line voltage
10	SM4	Out	Fourth phase of stepper motor
11	SM3	Out	Third phase of stepper motor
12	SM2	Out	Second phase of stepper motor
13	SM1	Out	First phase of stepper motor

JP7			
TO:	**Printer Module**		
Pin No.	**Name**	**I/O**	**Description**
1	CO		Collector of photo-transistor
2	VF		Anode of photo-sensor
3	L-GND	Power	Ground for logic
4	PRT_PWR	Power	Dot-line voltage
5	PRT_PWR	Power	Dot-line voltage
6	FP_PRI_DATA_OUT	Out	Data output
7	FP_STROBE6	Out	Sixth strobe
8	FP_STROBE5	Out	Fifth strobe
9	FP_STROBE4	Out	Fourth strobe
10	P-GND	Power	Ground for dot-line
11	P-GND	Power	Ground for dot-line
12	P-GND	Power	Ground for dot-line
13	P-GND	Power	Ground for dot-line
14	TM	In	Thermistor first terminal (second is ground)

J3 is a connector for the connection with the Key Board, a user input device. And each signal is defined as below.

J3			
TO:	**Key Board**		
Pin No.	**Name**	**I/O**	**Description**
1	POW_OUT	Out	For turn on/off power
2	POW_IN	In	For turn on/off power
3	-	-	Not used
4	-	-	Not used
5	SW1	In	Print key input
6	SW2	In	Scan key input
7	SW3	In	Up key input
8	SW4	In	Down key input
9	SW5	In	Right key input
10	SW6	In	Left key input
11	SW7	In	Enter key input
12	SW8	In	Power key input
13	-	-	Not used
14	-	-	Not used
15	VDD	Power	"+3.3V"
16	CK_LIGHT	In	Reserved
17	-	-	Not used
18	-	-	Not used
19	Ground	Power	Ground signal
20	Ground	Power	Ground signal

J4 is a connector for data exchange between PC and BioCon-500 through USB. The USB cable is the type-B. And each signal is defined as below.

J4			
TO:	**USB Interface**		
Pin No.	**Name**	**I/O**	**Description**
1	VUSB	In	+5V input from PC
2	D+	I/O	USB D+ line
3	D-	I/O	USB D- line
4	Ground	Power	Ground signal

1.3.2 Signal interface of the Analog Board

JP1 is a (+) terminal of the battery module connected from the battery module to the analog board through the Charge Board. And its signal is defined as below.

JP1			
TO:	**Charge Board**		
Pin No.	**Name**	**I/O**	**Description**
1	BAT_POS	Power	Input power from charge board
2	BAT_POS	Power	Input power from charge board

JP2 is a (-) terminal of the battery module connected from the battery module to the analog board through the Charge Board. And the signal is defined as below.

JP2			
TO:	**Charge Board**		
Pin No.	**Name**	**I/O**	**Description**
1	BAT_NEG	Power	Ground for input power from the Charge Board
2	BAT_NEG	Power	Ground for input power from the Charge Board

JP101 is a signal to control ON/OFF of DC power supplied from the DC adapter to the Charge Board. And its signal is defined as below.

JP101			
TO:	**Charge Board**		
Pin No.	**Name**	**I/O**	**Description**
1	ANP_PWR_ON	Out	Analog board power on/off
2	EE+5V	Power	"+5V"

JP3 is a connector linked to the ultrasonic probe. And it consists of signals for a driving of a stepping motor built in the ultrasonic probe, a signal for transmission and reception of the electric signals with ultrasonic oscillator, and a signal for reception of the input from the switch built in the ultrasonic probe. These signals are defined as below.

JP3			
TO:	**Ultrasonic Probe**		
Pin No.	**Name**	**I/O**	**Description**
1	Shield ground	Power	Cable shield
2	CHECK_CON2	in	Check Connector 2(Orange)
3	SCAN_SW & DATA	In	Scan switch input from probe (Grey)
4	-	-	Not Connected
5	ANGLE1	Out	Step motor control signal (Red)
6	CHECK_CON2	in	Check Connector 2 (Violet)
7	-	-	Not Connected
8	ANGLE2	Out	Step motor control signal (Blue)
9	-	-	Not Connected
10	ANGLE3	Out	Step motor control signal (White)
11	ANGLE4	Out	Step motor control signal (Black)
12	-	-	Not Connected
13	PLANE1	Out	Step motor control signal (Brown)
14	-	-	Not Connected
15	PLANE2	Out	Step motor control signal (Green)
16	PLANE3	Out	Step motor control signal (Pink)
17	PLANE4	Out	Step motor control signal (Yellow)
18	SIGNAL	I/O	Signal line (Coaxial +)
19	-	-	Not Connected
20	SIG_GND	Power	Signal ground (Coaxial Shield)

*. JP7, JP4, JP5: Refer to JP1, JP2, and JP3 of Control Board, respectively.

1.3.3 Signal Interface of the Key Board

J1 is a signal to deliver the key input from the user to the control board. And it is defined as below.

J1			
TO:	**Control Board**		
Pin No.	**Name**	**I/O**	**Description**
1	POW_OUT	In	For turn on/off power
2	POW_IN	Out	For turn on/off power
3	-	-	Not Connected
4	-	-	Not Connected
5	SW1	Out	Print key output
6	SW2	Out	Scan key output
7	SW3	Out	Up key output
8	SW4	Out	Down key output
9	SW5	Out	Right key output
10	SW6	Out	Left key output
11	SW7	Out	Enter key output
12	SW8	Out	Power key output
13	-	-	Not Connected
14	-	-	Not Connected
15	VDD	Power	"+3.3V"
16	-	-	Not Connected
17	-	-	Not Connected
18	-	-	Not Connected
19	Ground	Power	Ground signal
20	SIG_GND	Power	Signal ground (Coaxial Shield)

J2 is a connector for LEDs to display the status both of the DC adapter connection and of charging. And each signal is defined as below.

J2			
TO:	**Charge Board**		
Pin No.	**Name**	**I/O**	**Description**
1	ADAPTER_ON_ANODE	In	Adapter on LED anode
2	ADAPTER_ON_CATHODE	In	Adapter on LED cathode
3	FAST_CHARGE_ANODE	In	Fast charge LED anode
4	FAST_CHARGE_CATHODE	In	Fast charge LED cathode

1.3.4 Signal Interface of the Charge Board

J1 is a power input from DC adapter. And it is defined as below.

J1			
TO:	**DC Adapter**		
Pin No.	**Name**	**I/O**	**Description**
1	ADAPTER+	Power	+16V input
2	ADAPTER-	Power	Ground
3	-	-	Not Connected

J2 is a connector for LEDs to display the status both of the DC adapter connection and of charging. And each signal is defined as below.

J2			
TO:	**Key Board**		
Pin No.	**Name**	**I/O**	**Description**
1	ADAPTER_ON_ANODE	Out	Adapter on LED anode
2	ADAPTER_ON_CATHODE	Out	Adapter on LED cathode
3	FAST_CHARGE_ANODE	Out	Fast charge anode
4	FAST_CHARGE_CATHODE	Out	Fast charge cathode

J6 is a connector connected to (+) and (-) terminals of the battery board. And each signal is defined as below.

J6			
TO:	**Battery Board**		
Pin No.	**Name**	**I/O**	**Description**
1	BATTERY+	Power	Battery module plus
2	BATTERY-	Power	Battery module minus
3	-	-	Reserved

*. J7, J4, J5: Refer to JP101, JP1, and JP2 of Analog Board, respectively.

1.3.5 Signal Interface of the Battery Board

J1 is a connector connected to (+) and (-) terminals of the battery module. And it is defined as below.

J1			
TO:	**Battery Module**		
Pin No.	**Name**	**I/O**	**Description**
1	BATTERY-	Power	Battery module minus
2	-	-	Reserved
3	-	-	Reserved
4	-	-	Reserved
5	BATTERY+	Power	Battery module plus

J2 is a connector connected to (+) and (-) terminals of the battery board. And it is defined as below.

J2			
TO:	**Battery Board**		
Pin No.	**Name**	**I/O**	**Description**
1	BATTERY-	Power	Battery module minus
2	-	-	Reserved
3	-	-	Reserved
4	-	-	Reserved
5	BATTERY+	Power	Battery module plus

2. The Component of the Product

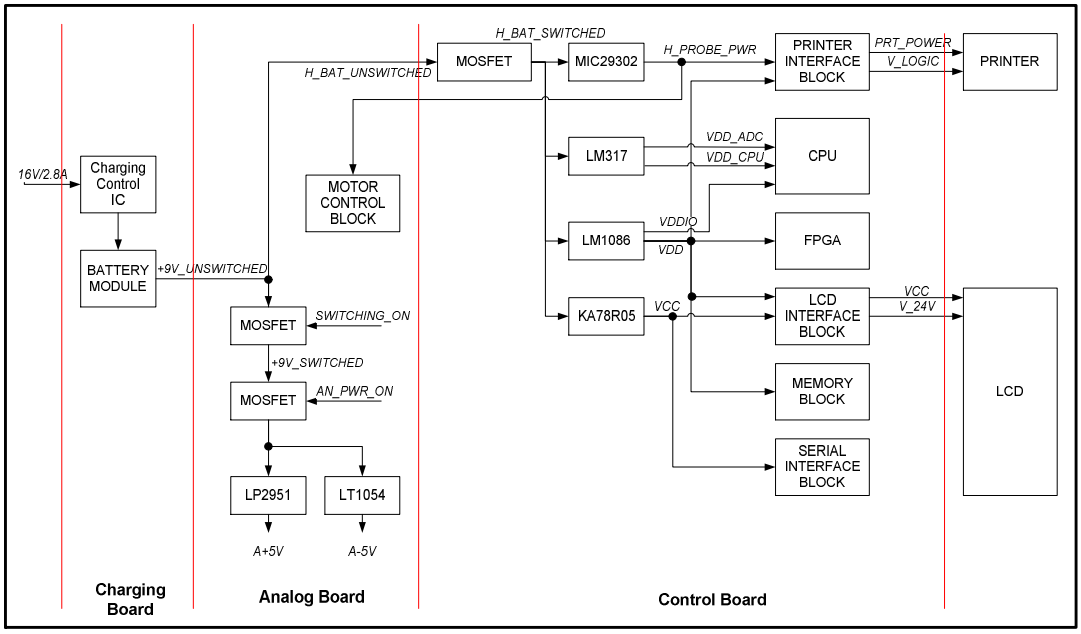
2.1 DC Adapter

Supplies the DC power required in charging the battery module. And its specification is as below.

Section	Specification	
Input	100 ~ 240V, 50~60Hz, 1.2A	
Output	+16V, 2.8A	
DC Plug	Inner part	Positive
	Outer part	Negative

(Specification of DC Adapter)

The power system supplied through DC adapter has the following connection configuration.



(Connection Configuration of Power Signal in BioCon-500)

2.2 Ultrasonic Probe

Transmits the ultrasonic pulse in close contacts with the patient's bladder and sends the received signals reflected from the human body to the analog board band. Ultrasonic probe consists of a transducer assembly, two motors used in adjusting the location of a transducer assembly, and a switch board for receiving the scan start input from the user. The product specification is as below.

Section	Specification
Output Power	1mW maximum
The Working Frequency	2.8MHz
6dB beam area	5.85mm (H) 4.99mm (V)
The maximum value of the temporal average	0.0313 mW/cm^2
Transducer Dimension	14mm diameter

(Specification of the Ultrasonic Probe)

2.3 Battery Module

Is a power source to supply the power to the system. And its specification is as below.

Section	Specification	
Configuration	2S+2P	
Voltage	7.4V	
Operating Temperature	Standard Charge	0 to 45 ℃
	Standard Discharge	-10 to 50 ℃

(Specification of the Battery Module)

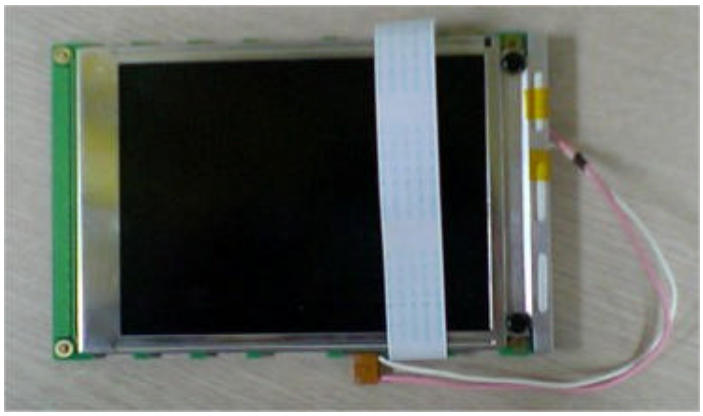
2.4 LCD Module

Is a display device to display various information adjusted by the user. And its specification is as below.

Section	Specification
Display Resolution	320(W) x 240(H) (dots)
Dot Size	0.33(W) x 0.33(H) (mm)
Dot Pitch	0.36(W) x 0.36(H) (mm)
Display Type	FSTN (Black and White), Transmissive
Duty	1/240
Backlight	CCFT inverter

(Specification of the LCD Module)

The actual picture of LCD module is as below.



(Actual Picture of LCD Module)

2.5 Printer Module

A thermal printer to print out visualized bladder information and visual images. And its specification is as below.

Section	Specification
Printing Method	thermal dot line printing
Resolution	8 dots/mm
Dot per line	384 dots
Printing Width	48 mm
Paper width	57.5 ± 0.5 mm

(Specification of Printer Module)

2.6 Charge Board

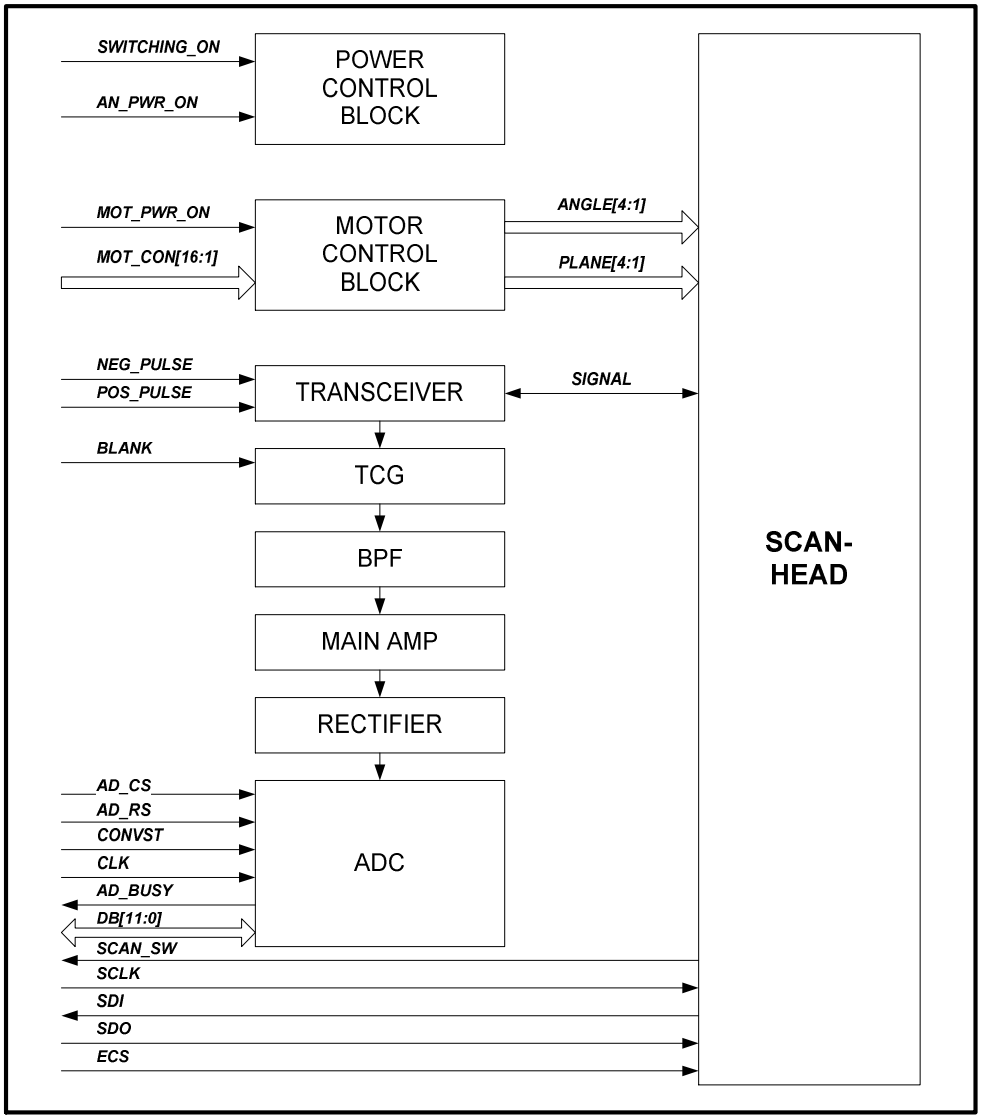
It charges the battery module with the DC power input from DC power adapter. The configuration of the Charge Board is as below.

Section	Specification	
Max charging current	1000 mA	
Max charging voltage	8.4 ± 0.05 V	
LED Display	Fault	Red
	Full charge	Yellow

(Specification of Charge Board)

2.7 Analog Board

It transmits the ultrasonic pulse to ultrasonic probe, performs the signal process of signals received by the ultrasonic probe, and sends the data converted through the A/D converter to the control board. Also, it drives the stepping motor required in scanning. The block diagram of Analog board is as below.



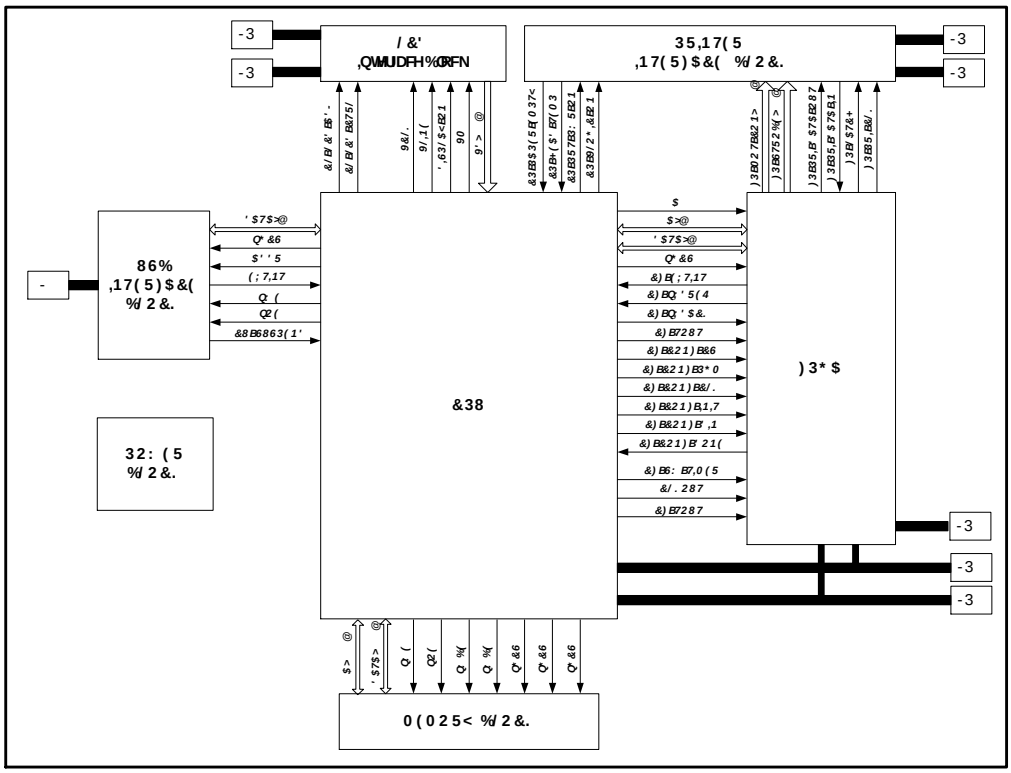
(Block Diagram of Analog Board in BioCon-500)

Each block of Analog board has following function.

Classification	Function
Power Control Block	Controls ON/OFF of power required in analog board and supplies the power required in each component.
Motor Control Block	A motor-driving module for the ultrasonic probe.
Transceiver	A module that generates the pulse required in the ultrasonic wave generation and receives the ultrasonic reflection signal from the ultrasonic probe.
TCG	TCG (Time Controlled Gain) block to impose Internal time-varied gain.
BPF	A band pass filter module to remove the undesired frequency signal other than the required signal.
Main Amp.	A main amplifier module to impose overall gain to the signal.
Rectifier	Rectifies the signal before A/D conversion.
ADC	Transmits the data to the control board by converting analog into digital.

2.8 Control Board

The control board is in charge of the signal for overall system and other various signals. And its configuration is as below.



(Block Diagram of Control Board in BioCon-500)

The function of each module in the control board is as below.

<table>
<tr><th>Classification</th><th>Function</th></tr>
<tr><td>Power Block</td><td>Supplies various powers required in control board.</td></tr>
<tr><td>USB Interface Block</td><td>Provides USB interface with PC and supports USB 1.1 full speed.
The connector type is standard USB B type.

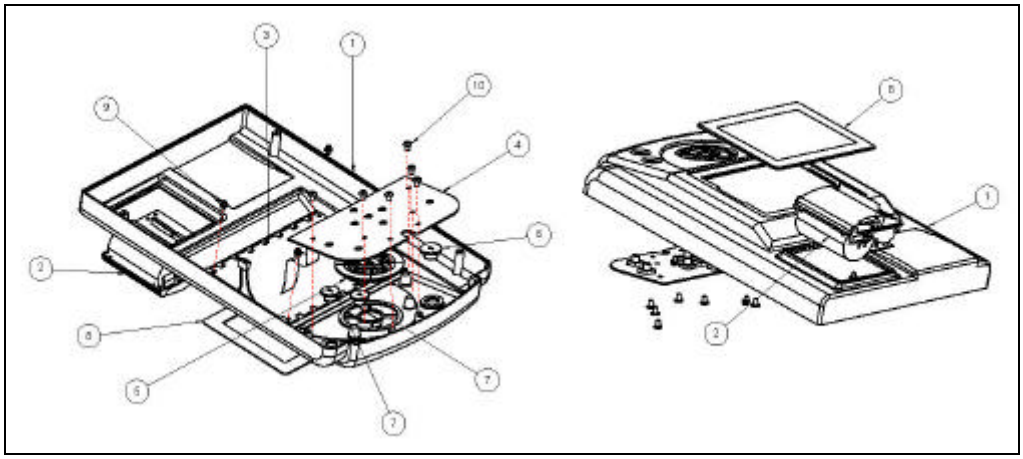
<Picture of USB cable></td></tr>
<tr><td>Memory Block</td><td>The memory block has a control S/W and a booting S/W and it includes RAM memory required in driving the control S/W.
<table><tr><th>Reference NO.</th><th>Capacity</th><th>Type</th><th>Purpose</th></tr><tr><td>U1</td><td>8M bits</td><td>SRAM</td><td>RAM section</td></tr><tr><td>U2</td><td>8M bits</td><td>Flash ROM</td><td>Control device</td></tr><tr><td>U3</td><td>8M bits</td><td>Flash ROM</td><td>Booting
Store scan data & system information</td></tr></table>(Configuration of memory)</td></tr>
<tr><td>FPGA</td><td>A module performing such functions as chattering removal for key input by the user, serial data transmission to the thermal printer, motor control logic, and memory decoder.</td></tr>
<tr><td>LCD Interface Block</td><td>Provides interface with LCD.</td></tr>
<tr><td>Printer Interface Block</td><td>A module to drive motor of thermal printer.</td></tr>
</table>

3. Structure and Assembling of the Device

3.1 Structure and Assembling of the Upper Case

3.1.1 Structure and Components of the Upper Case

The main components constituting the Upper Case of the device are the Printer Module, the LCD Module and the Key Board. The structure is as below.

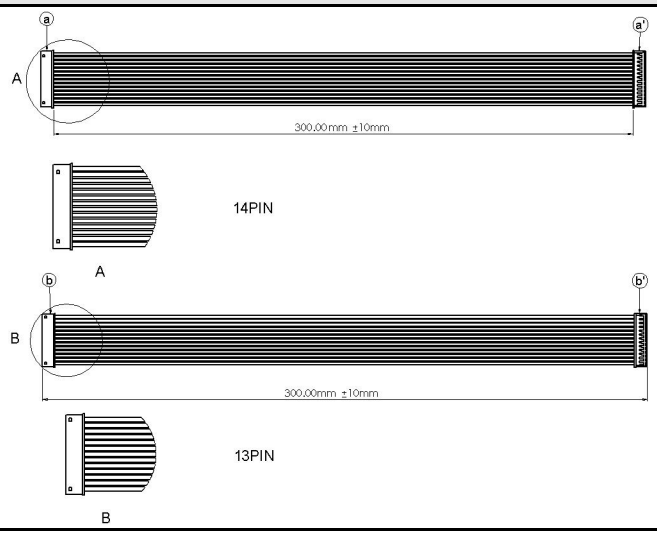
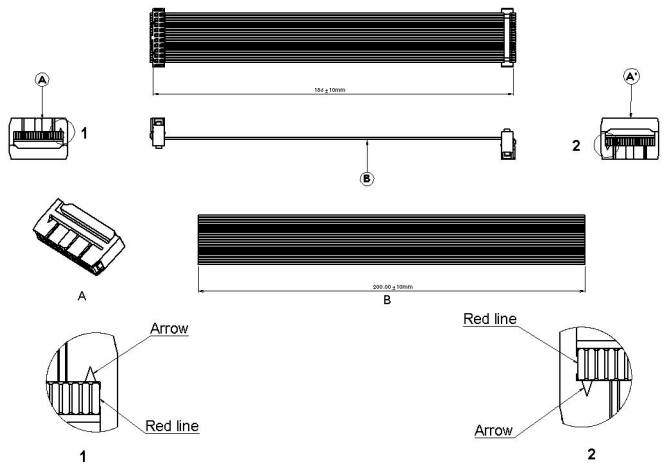
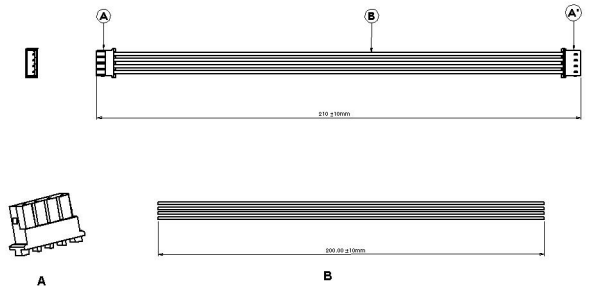
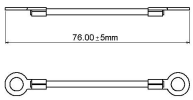


(Structure of the Upper Case of the Device)

The items included in the upper case of the device are as below.

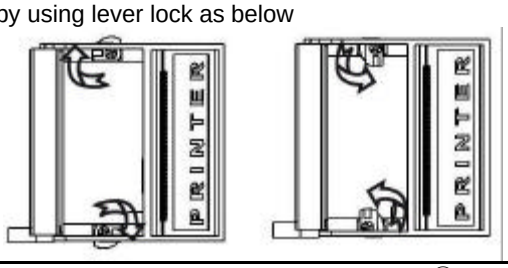
No.	Name	Material	Q'TY
①	Upper Case (disassembled)	PC/ABS	1EA
②	Printer Module		1EA
③	LCD Module		1EA
④	Key Board	PCB	1EA
⑤	Direction Button (gray)	SILICONE	1EA
⑥	PWR Button (red)	SILICONE	1EA
⑦	PRINT/SCAN Button (blue)	SILICONE	2EA
⑧	LCD Window	PC 2.5T	1EA
⑨	M3 washer Bolt (6mm)	STEEL	4EA
⑩	M4 screw Bolt (10mm)	STEEL	6EA

The cables used in the upper case of the device are as below.

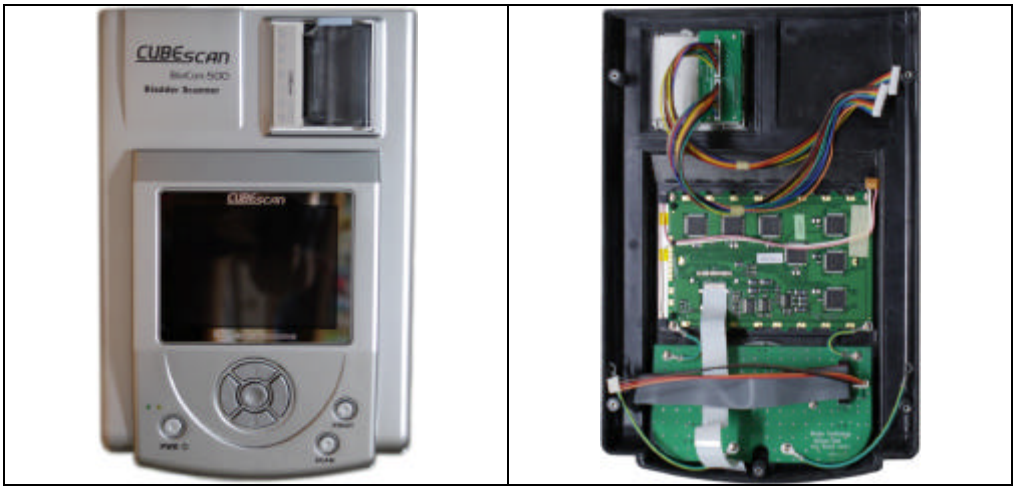
No.	Name	Drawing	Q'TY
⑪	Printer Cable		1SET
⑫	Key Board Cable		1EA
⑬	LED Cable		1EA
⑭	LCD GND Cable		2EA
⑮	Key Board GND Cable		2EA

3.1.2 Assembling of the Upper Case

The assembling of the upper board takes the following steps, and the steps are reversed for the dissembling.

Step	Description	Remark
1	Attach the ⑤Direction Button, the ⑥PWR button, and the ⑦ PRINT/SCAN Button to the ④Key Board.	
2	Attach the ④Key Board assembled in step 1 to the rear lower of the ①Upper Case by using the ⑩M3 washer bolts.	⑧ X 6EA
3	Attach the ③LCD Module to the rear center of the ①Upper Case by using the ⑨M3 washer bolts.	⑨ X 4EA
4	Insert the ②PRINT Module to the grooves of front upper, then attach it by using lever lock as below 	
5	Remove the adhesive paper from the rear of the ⑧LCD Window, then attach in the front center of the ①Upper Case.	
6	Connect the ③LCD Module and the ④Key Board by using the ⑭LCD GND Cables and the fixing holes of them.	⑭ X 2EA
7	Connect the ⑮Key Board GND Cable to the fixing holes in lower of the ④Key Board.	⑮ X 2EA
8	Connect the ⑪Printer Cable to the ②PRINT Module.	⑪ X 1SET
9	Connect the ⑫Key Board Cable to the ④Key Board.	⑫ X 1EA
10	Connect the ⑬LED Cable to the ④Key Board.	⑬ X 1EA

The picture of the Upper Case assembled is as below.

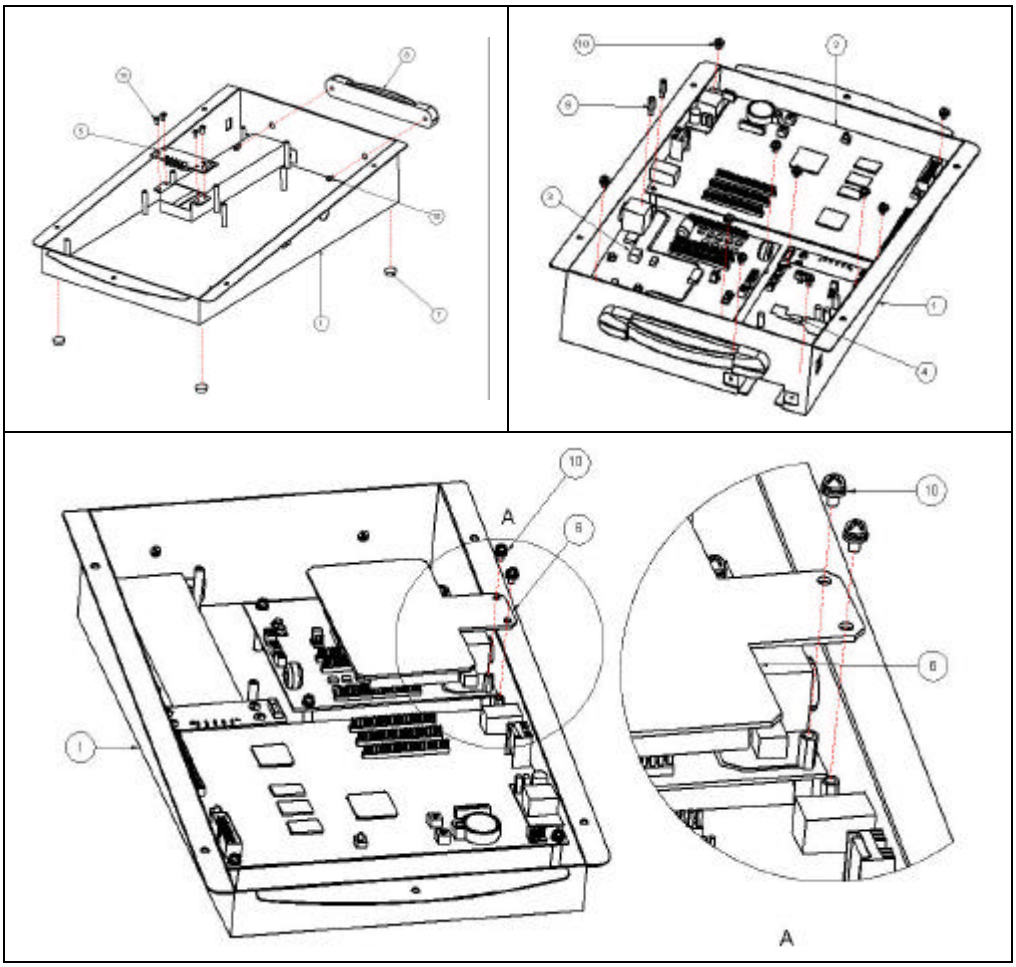


(The Picture of the Upper Case Assembled)

3.2 Structure and Assembling of the Lower Case

3.2.1 Structure and Components of the Lower Case

The main components constituting the Lower Case of the device are the Control Board, the Analog Board, the Charge Board, and the Battery Board.
The structure is as below.

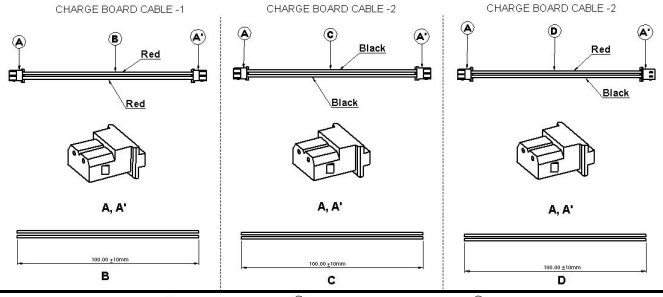
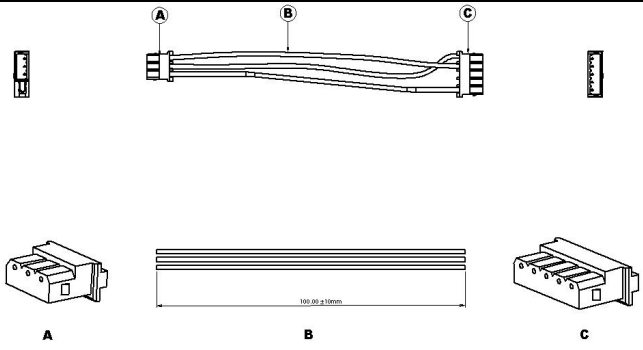


(Structure of the Lower Case of the Device)

The items constituting the Lower Case of the device are as below.

No.	Name	Material	Q'TY
①	Lower Case (disassembled)	SHEET METAL	1EA
②	Control Board	PCB	1EA
③	Analog Board	PCB	1EA
④	Charge Board	PCB	1EA
⑤	Battery Board	PCB	1EA
⑥	Connection Board	PCB	1EA
⑦	Spacer	SILICONE	4EA
⑧	Handle	Plastic	1EA
⑨	Supporter (M3, 12mm)	STEEL	2EA
⑩	M3 Washer Bolt (6mm)	STEEL	20EA

The cables used in the Lower Case of the device are as below.

No.	Name	Drawing	Q'TY
⑪	Power Cable		1SET
⑫	Battery Cable		1EA

3.2.2 Assembling of the Lower Case

The assembling of the Lower Case takes the following steps. And the steps are reversed for the disassembling.

Step	Description	Remark
1	Attach the ⑦Spacers to the ①Lower Case with 10mm from the ①Lower Case edge.	⑦ X 4EA
2	Attach the ⑧Handle by using the ⑩M3 Washer Bolts.	⑩ X 2EA
3	Attach the ②Control Board, the ③Analog Board, the ④Charge Board, and the ⑤Battery Board to the ①Lower Case by using the ⑩M3 Washer Bolts.	⑩ X 16EA
4	At this time, the upper right hole of the ②Control Board and the lower right hole of the ③Analog Board must be attached by the ⑨Supporter.	⑨ X 2EA
5	Connect the ⑥Connection Board into the ②Control Board and the ③Analog Board in the correct direction, and attach them by using ⑩M3 Washer Bolts.	⑩ X 2EA
6	Connect the ⑥Charge Board and the ③Analog Board by using the ⑪Power Cables.	⑪ X 1SET
7	Connect the ⑥Charge Board and the ⑤Battery Board by using the ⑫Battery Cable.	⑫ X 1EA

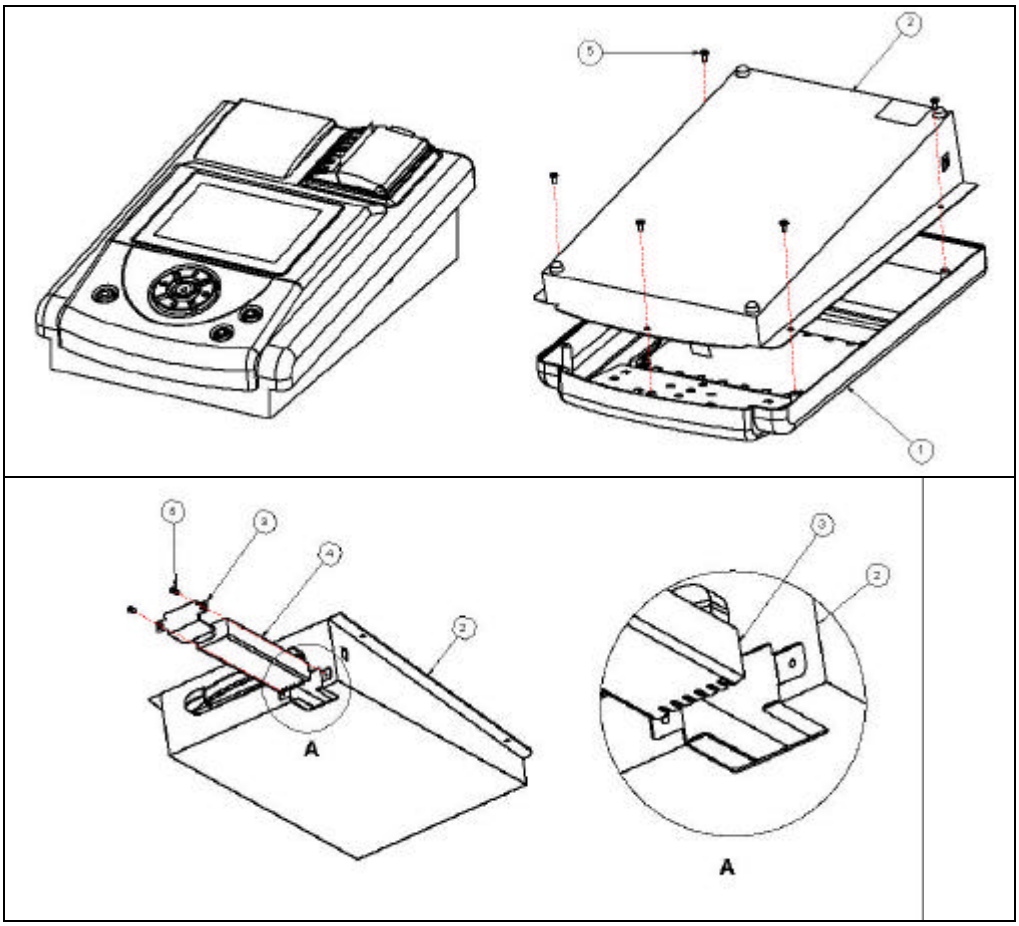
The picture of the assembled lower case is as below.

(The Picture of the Lower Case Assembled)

3.3 Structure and Assembling of the Console

3.3.1 Structure and Components of the Console

The components constituting the Console of the device are the Upper/Lower Case assembled and the Battery Module. The structure is as below.



(Structure of the Console of the Device)

The items constituting the Console of the device are as below.

No.	Name	Material	Q'TY
①	Upper Case (assembled)		1EA
②	Lower Case (assembled)		1EA
③	Battery Cover	SHEET METAL	1EA
④	Battery Module		1EA
⑤	M3 Flat Head Bolt(6mm)	STEEL	7EA

3.3.2 Assembling of the Console

The assembling of the Console takes the following steps. And the steps are reversed for the disassembling.

Step	Description	Remark
1	Connect the Key Board GND Cable to the Control Board	
2	Connect the data cable and the backlight cable of the LCD Module to the Control Board.	
3	Connect the Key Board Cable to the Control Board.	
4	Connect the Printer Cable to the Control Board.	
5	Connect the LED Cable to the Charge Board.	
6	Attach the ①Upper Case to the ②Lower Case by using the ⑤Flat Head Bolts.	⑤ X 5EA
7	Insert the ④Battery module into the battery hole in the correct direction.	
8	Cover the ③Battery Cover by using the ⑤Flat Head Bolts	⑤ X 2EA

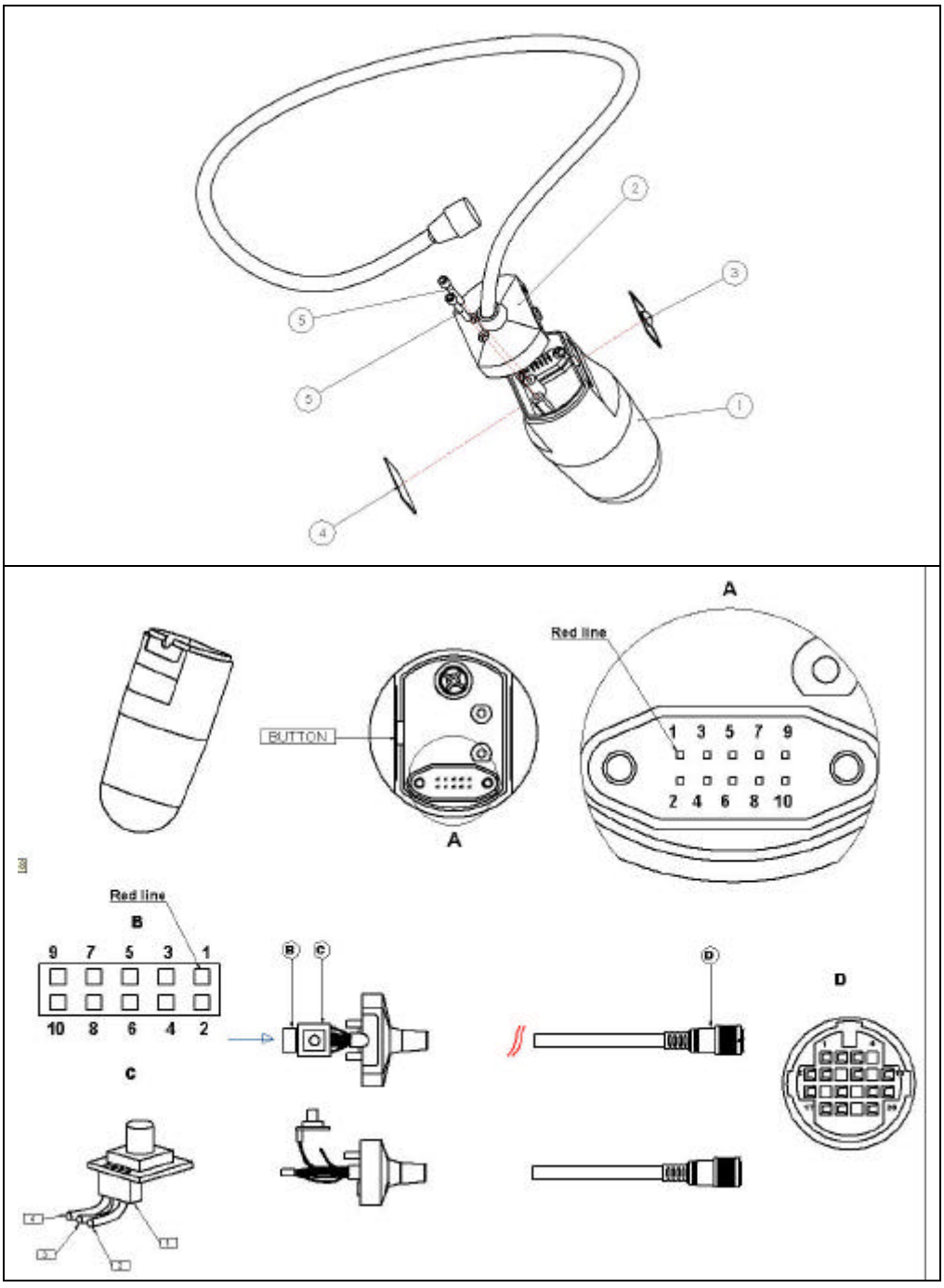
The picture of the assembled the Console is as below.

(The Picture of the Console Assembled)

3.4 Structure and Assembling of Ultrasonic Probe Module

3.4.1 Structure and Components of Ultrasonic Probe Module

The main components constituting the Ultrasonic Probe Module are the Probe and the Probe Cable. The structure of the Ultrasonic Probe Module is as below.



(The Structure and Connection of the Ultrasonic Probe Module)

The components constituting the Ultrasonic Probe Module are as below.

No.	Name	Material	Q'TY
①	Probe		1EA
②	Probe Cable		1EA
③	Button Sheet	PC	1EA
④	S/N Sheet	PC	1EA
⑤	Ranch Bolt M3 20mm	STEEL	2EA

3.4.2 Assembling of Ultrasonic Probe Module

The assembling of the ultrasonic probe module takes the following steps. And the steps are reversed for the disassembling.

Step	Description	Remark
1	Connect signal line (**A** and **B**) into housing by wire color in the right direction. Show in a picture of the previous page	
2	Attach the ②Probe Cable to the ①Probe by using the ⑤Ranch Bolt.	
3	Attach the ③Button Sheet where the button is located	
4	Attach the ④S/N Sheet to the opposite side of the ③Button Sheet	

The picture of the Ultrasonic Probe Module assembled is as below.

(The Picture of the Assembled Ultrasonic Probe)

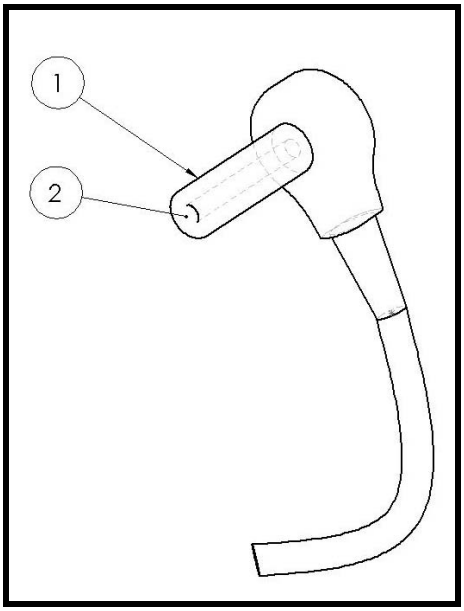
4. External Cable Configuration

The external cable constituting BioCon-500 consists of the connection with DC adapter, the connection with ultrasonic probe, the connection with Serial port of PC, and the cable for the connection with USB of PC.

- DC adapter cable
- Ultrasonic probe cable
- USB cable

4.1 DC Adapter Cable

DC adapter supplies DC power required in battery module for the system operation by the battery in BioCon-500™. It supplies the power to BioCon-500™ from the DC adapters through a cable as below.



(DC Adapter Cable)

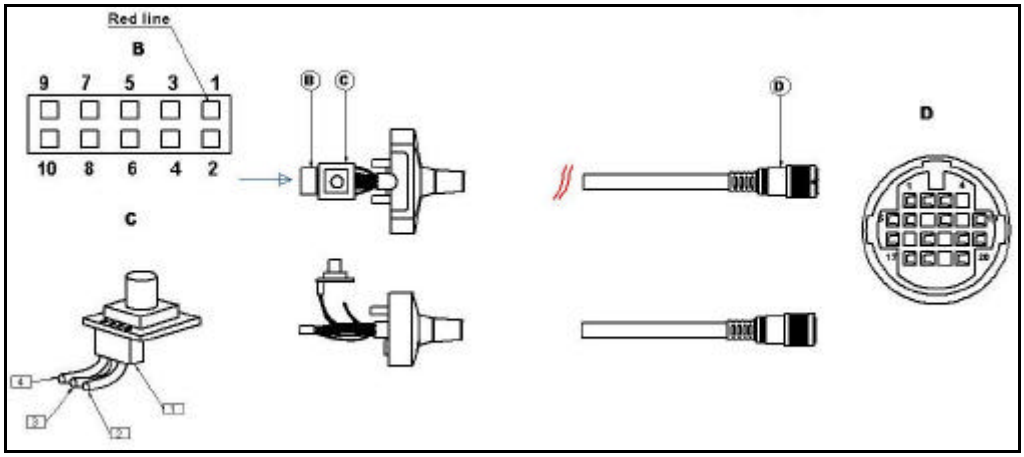
The signal of DC adapter cable is defined as below.

Pin No.	Description
1	Ground
2	+16V input

(Pin Configuration of DC Adapter Cable)

4.2 Ultrasonic Probe Cable

The cable between the Console and the Ultrasonic Probe consists of ultrasonic, motor control, and user input signals as the following structure. In the figure below, **D** is a terminal connected to the Console, while **B** and **C** are the terminals located within the Probe.



(Configuration of the Ultrasonic Probe Cable)

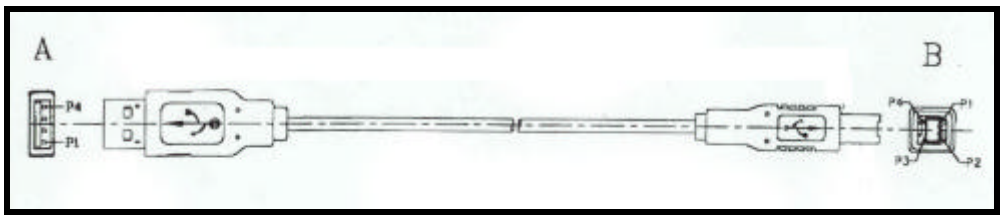
The signal configuration at the Ultrasonic Probe Cable is as below.

D (Pin No.)	B (Pin No.)	C (Pin No.)	Color	Description
1		①		Cable shield
2		④	orange	Check Connector 2
3		②	grey	Scan Switch input from probe
4			-	Not Connected
5	1		red	Control signal for step motor
6		③	violet	Check Connector 1
7			-	Not Connected
8	2		blue	Control signal for step motor
9			-	Not Connected
10	3		white	Control signal for step motor
11	4		black	Control signal for step motor
12			-	Not Connected
13	9		brown	Control signal for step motor
14			-	Not Connected
15	10		green	Control signal for step motor
16	7		pink	Control signal for step motor
17	8		yellow	Control signal for step motor
18	6			Signal line (Coaxial +)
19			-	Not Connected
20	5			Signal ground (Coaxial shield)

(Pin Configuration of the Ultrasonic Probe Cable)

4.3 USB Cable

Data exchange between the Console of BioCon-500 and PC is made through the USB. The terminals of BioCon-500 and of PC are USB B-type connector and USB A-type connector, respectively. And its figure is as below.



(USB Cable: Connection between BioCon-500 and PC)

USB B-type terminal of BioCon-500 and USB A-type terminal of PC are connected in signal colors as below.

USB A-TYPE	Wire Color	USB B-TYPE
1	RED	1
2	WHITE	2
3	GREEN	3
4	BLACK	4
Case	SHEEL	Case

(Pin Configuration of USB Cable)

5. Signal Test

5.1 Test for the Analog Board

To check and test the signal of the analog board, following measurement devices are required.

- Digital multi-meter
- Digital oscilloscope

Test the analog board by checking the signal with above measurement devices in the following order.

5.1.1 Power Test

① Turn on the analog board.
② Test the power for below location by using multi-meter.

Location	Measured Value
TP1 & '+' of C40	+5V (+/- 5%)
TP1& '-' of C48	-5V (+/- 5%)
TP1& TP8	+7V (+/- 5%)

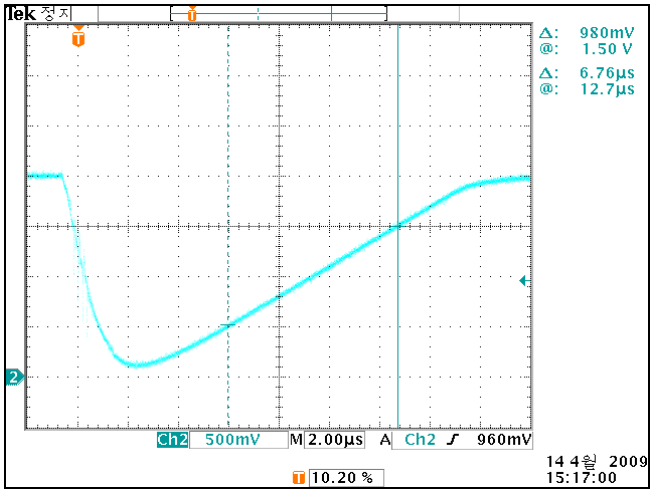
5.1.2 TCG1 Test

① Turn on the analog board.
② Set up Oscilloscope as below and connect the probe to TP10.

Item	Setup Value
Axis of Voltage	0.5 [V]
Axis of Time	2 [us]
Trigger Level	+500 [mV]
Trigger Method	Single Shot

③ Press the scan button of BioCon-500
④ Measure the rising time of the voltage measured with Oscilloscope from 0.5V to 1.5V.

-The signal is measured in the following figure.



(The Figure of TCG1 Measurement Signal)

- At this time, the value during the rising period must be measured as below.

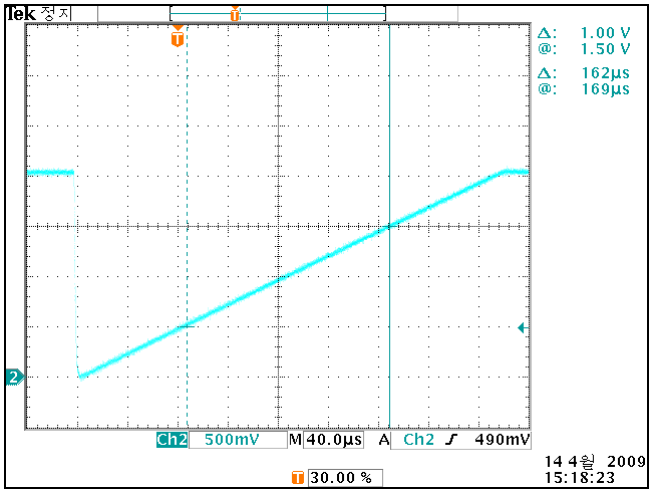
Item	Measured Value
Rising Time	5.5 ~ 7.2[us]

5.1.3 TCG2 Test

① Turn on the analog board.
② Set up Oscilloscope as below and connect the probe to TP11.

Item	Setup Value
Axis of Voltage	0.5 [V]
Axis of Time	40 [us]
Trigger Level	+500 [mV]
Trigger Method	Single Shot

③ Press the scan button of BioCon-500
④ Measure the rising time of the voltage measured with Oscilloscope from 0.5V to 1.5V.
- The signal is measured in the following figure.



(The Figure of TCG2 Measurement Signal)

- At this time, the value during the rising time must be measured as below.

Item	Measured Value
Rising Time	156 ~ 172 [us]

5.1.4 Ultrasonic Pulse Test

① Turn on the analog board.

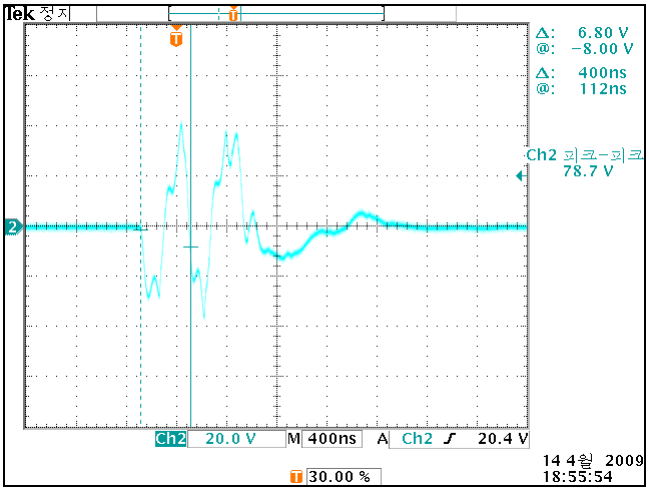
② Set up the Oscilloscope as below and connect the probe to TP6.

Item	Setup Value
Axis of Voltage	20 [V]
Axis of Time	400 [ns]
Trigger level	+20 [V]
Trigger Method	Single Shot

③ Press the scan button of BioCon-500

④ Measure the voltage shape measured by Oscilloscope

-The signal is measured in the following figure.



(Figure of the Ultrasonic Pulse Signal)

- The peak-to-peak voltage at TP6 must be measured in the following scope.

Item	Measured Value
Vpp @TP6	60 ~ 90 [V]

5.2 Test for the Control Board

To check and test the signal of the Control board, following measurement devices are required.

- Digital multi-meter

Test the analog board by checking the signal with above measurement devices in the following order.

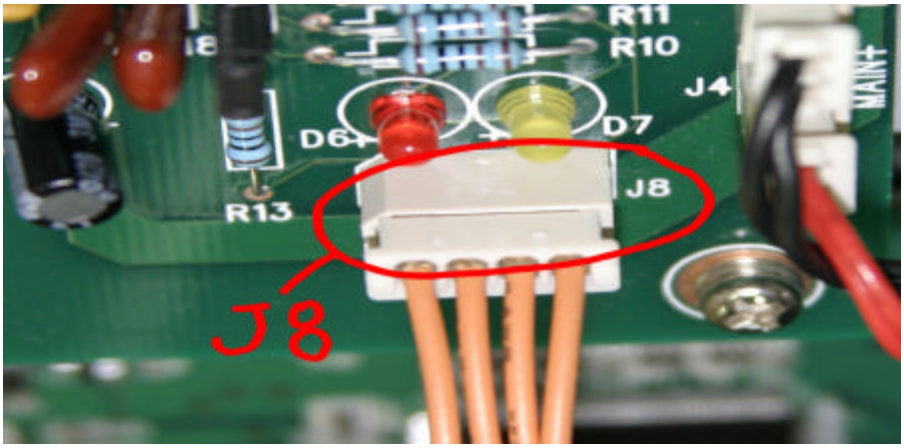
5.2.1 Power Test

① Turn on the system
② Test the power for below location by using multi-meter.

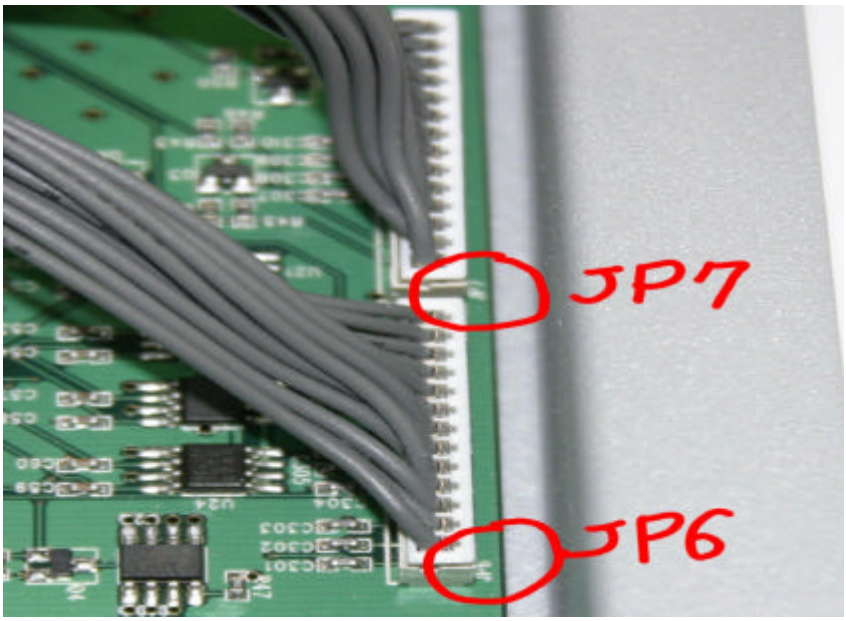
Location	Measured Value
U18.1 & U18.3	+7.4 ~ +8.4V
U18.1 & U18.2	+3.3V (+/- 5%)
U16.3 & U16.4	+6V (+/- 5%)
"+" & "-" of C48	+2.5V (+/- 5%)
"+" & "-" of C50	+5V (+/- 5%)

5.2.1 LCD Test

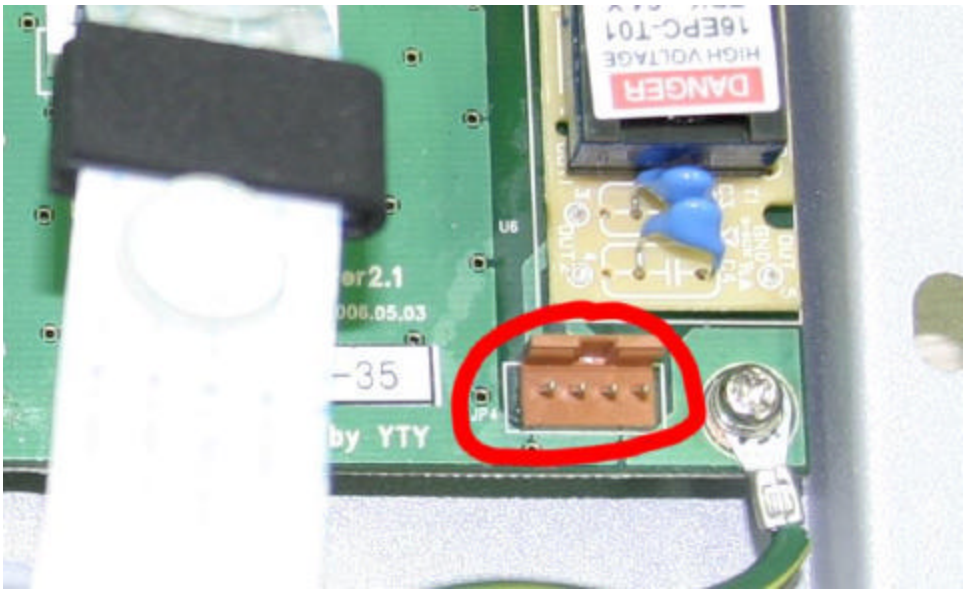
① Turn on the system.
② Remove the 5 bolts connecting the top case to the bottom case.
③ Open the top case.
④ Remove the cable in J8 from charging board.



⑤ Remove two cables in JP6, JP7 from control board.

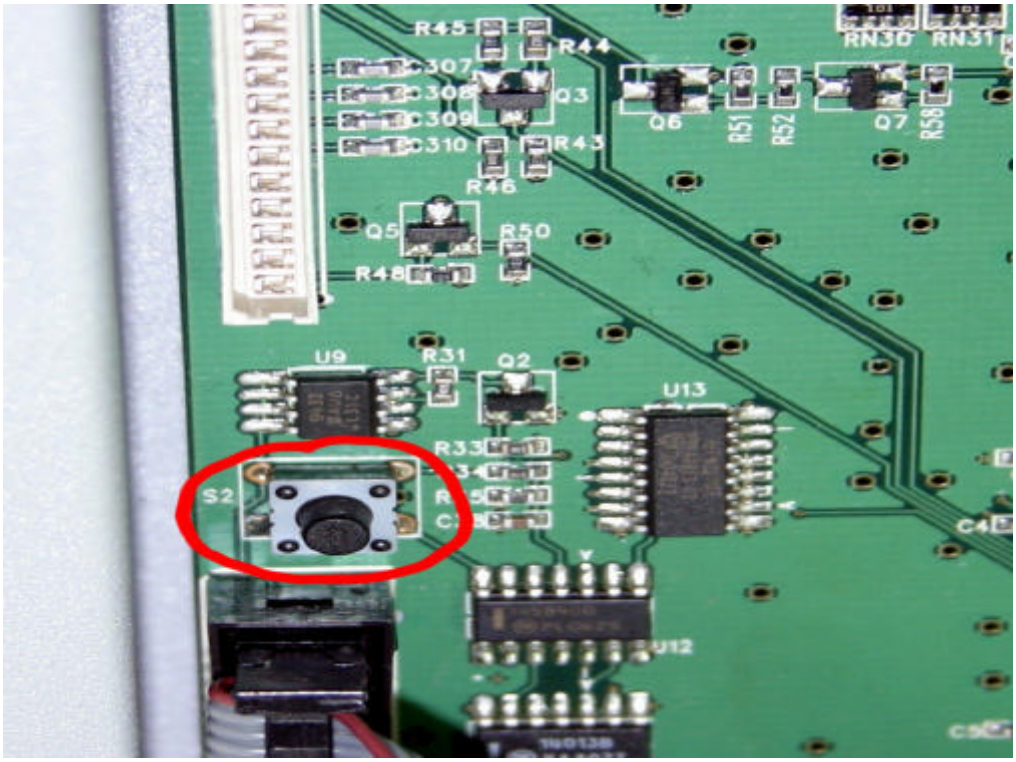


⑥ Remove the backlight cable in JP4 from control board.

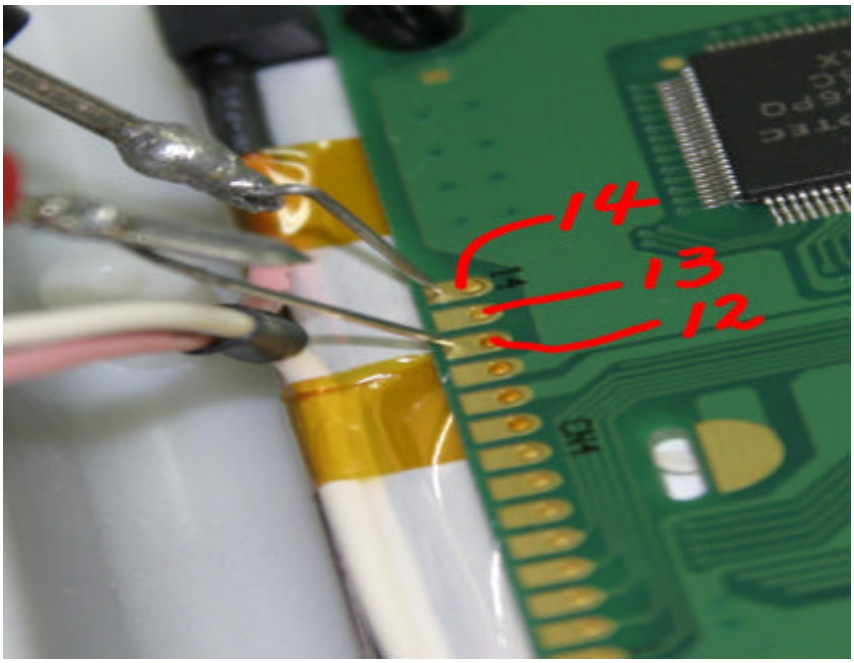


⑦ After removing 4 cables you can lay down the top case as follows.

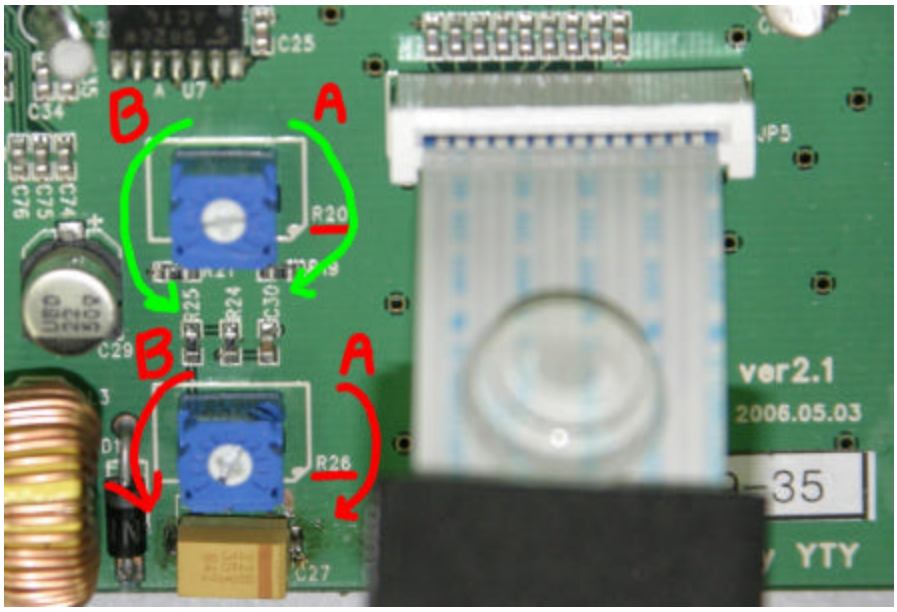
⑧ Turn on the system by pressing the switch S2 in control board.



⑨ Check the voltage between Pin 14 and Pin 12 in LCD module using digital multimeter.



* PIN 14: Ground, Black
* PIN 12: +, Red
* Set the voltage to -23V, by changing the resistance value of R26.
- R26:
Turning clockwise (A direction), the absolute driver voltage is lowered.
Turning counter-clockwise (B direction), the absolute driver voltage is raised



WARING: The voltage between pin14 and pin12 shall not exceed -25V.
Over voltage will destroy the LCD module.

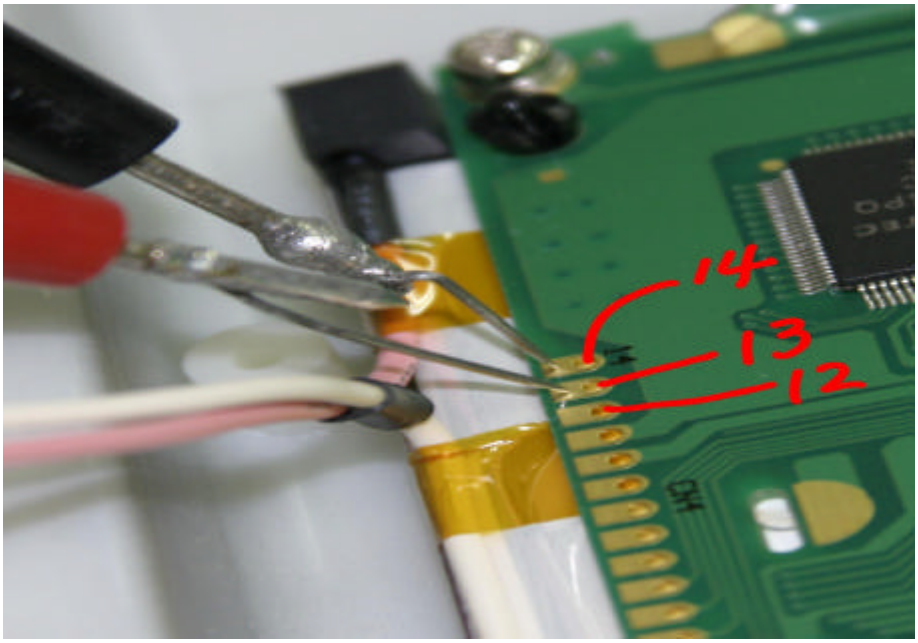
⑩ Set the voltage to -18V, between pin14 and pin13 by turning R20.

⑪ Turn off the device.

⑫ Connect again LCD backlight cable to JP4 in control board.

⑬ Turn on the device again.
After that, turn R20 so you can get the adequate brightness of LCD.

- R20:
Turning clockwise (A direction), the absolute driver voltage is raised
Turning counter-clockwise (B direction), the absolute driver voltage is lowered.



6. Troubleshooting

6.1 System is not turned on.

No.	Check point	Description
1	Is POWER key pressed for more than 1 second?	The system operates when pressing the POWER key for more than 1 second.
2	Measure the voltage of battery module.	More than +7V
3	Is battery module connected?	If not connected, connect the battery module.
4	Is the connector connected between the Key Board and control board?	Connect the connector between two boards.
5	Not solved yet?	Exchange the control boards

6.2 System is not turned off.

No.	Check point	Description
1	Is POWER key pressed more than 1 second?	The system operates when pressing POWER key for more than 1 second.
2	Is the system not turned off even when pressing the Power key for more than 1 second?	Turn the power off by removing the battery module from the system. And exchange control boards.

6.3 Initial screen is not displayed when turning the system on.

No.	Check point	Description
1	Is backlight on in LCD?	Check if the connector for backlight of LCD is connected properly.
2	Is the FPC connector to the LCD module well connected?	Check if the connector is connected properly.
3	Check the voltage between the Control board ground and 12th pin of JP5.	Check if -23V (+/-1V).
4	Check the voltage between the Control board ground and 13th pin of JP5.	Check if -18V (+/-1V).
5	Is the system turned off?	Try again after replacing the LCD module.
6	The system is not turned off.	Test again after replacing the Control board.

6.4 The green LED is not turned on even when the power adapter is connected.

No.	Check point	Description
1	Is green LED not turned on even when the system is OFF?	Yes ->Refer to item 2. No -> Refer to item 4
2	Is the 4 pin connector connecting the Key Board and the Charge Board connected?	Check the connection status and if not connected, connect the 4 pin connector.
3		Replace the Charge Board.
4	Green LED is on when the system is OFF, but it is turned off when the system is ON.	No problem. Because of charging control in Control board sometime Green LED is off when system is on.

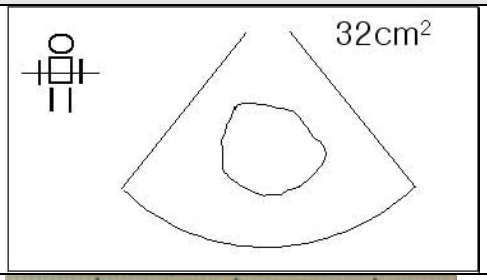
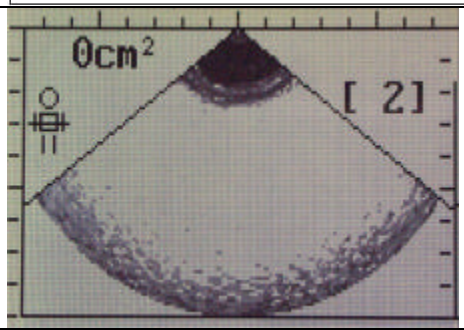
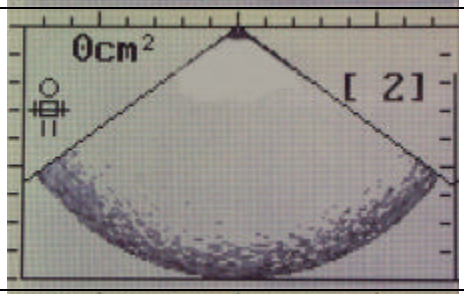
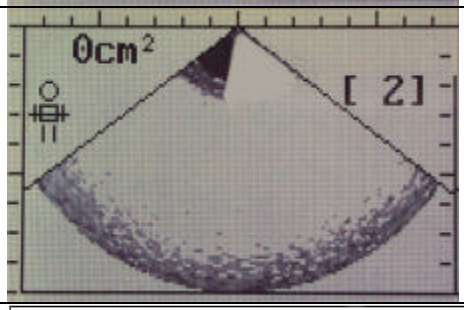
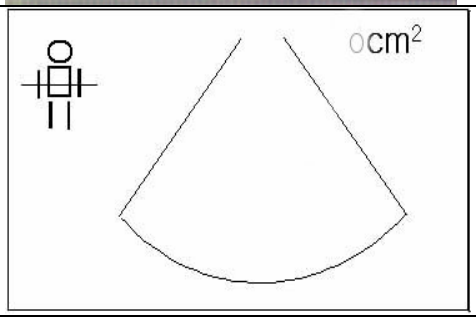
6.5 NO SCANHEAD message is displayed during scanning.

No.	Check point	Description
1	Is the ultrasonic probe connected well to the Console?	If not, NO SCANHEAD message is displayed when the scan button is pushed.
2	Is open between the 3rd and 6th pin of the probe connector?	Test again after replacing with other ultrasonic probe.
3	The message is displayed when the 3rd and 6th pin of Probe connector is short	Request service from the headquarter

6.6 NO PAPER message is displayed during printing.

No.	Check point	Description
1	Does printer module have thermal paper?	If not, insert thermal paper.
2	Does message still appears even when there is paper?	Try again after replacing the control board.

6.7 No image is displayed after scanning.

No.	Check point	Description
1		In this case, the mode showing the scan result is set as CONTOUR.
2		Normal Image Scanned image from open object (in air)
		Image when the transducer connection is open. Check the resistance from the ultrasonic probe connector to the 18th and 20th pin
		Error in transducer connection. Retry after replacing the probe
3		Check if 'SCAN RESULT' is set as 'CONTOUR'. Yes, retry after setting as 'B-MODE'. No, request service from the headquarter.

6.8 The system is turned off while in use.

No.	Check point	Description
1	Is auto power-off on in the setup menu of Maintenance mode?	When auto power-off function is active, system will be turned off if no key input is made during the fixed time.
2	Is the system turned off with the message of “BATTERY LOW, SYSTEM WILL BE TURNED OFF”?	Turn off the system to protect the battery module if the power is insufficient. Try again after charging.

6.9 Error in motor rotation during scan operation

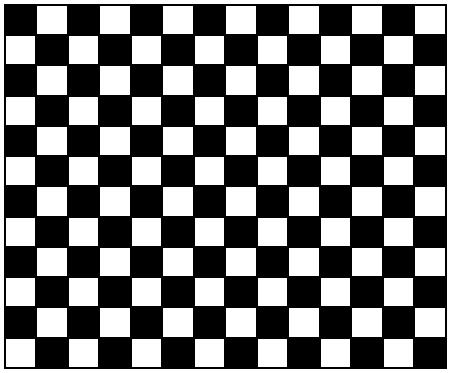
No.	Check point	Description
1	Check error in motor. Measure the resistance of each case in probe Connector 1) Pin number 5 and 8 2) Pin number 10 and 11 3) Pin number 13 and 15 4) Pin number 16 and 17	Normal resistance value 15 +/- 1 (Ohms)
2	In case of normal resistance	Test again after replacing with other analog board

6.10 Error in Printing (No feeding)

No.	Check point	Description
1	Thermal Paper	No paper. Properly inserted.
2	Motor sound?	Yes, go to 3 No, check the printer connector
3	Not solved?	Replace control board.

7. Maintenance Mode

Maintenance mode can be used to adjust the system variables before the shipment. Set-up of those variables follows the procedure below.

No.	LCD Screen	Manipulation
1	Check ID OK!!! Erase Sector OK!!! Blank Check OK!!! Program OK!!! Verify OK!!! Programming is completed!!!	To enter the Maintenance mode, push LEFT key with ENTER key being pushed and then push PRINT key after the system is turned on and the initial screen is displayed in normal mode. At this time, the information as left is displayed on the screen.
2		Turn off the system and again turn it on to have the checkers as shown left on LCD.
3		When the system is booted in maintenance mode, the message “MAINTENANCE MODE” will be displayed on the lower part of the screen as left.

4	<<MAINTENANCE MODE>> Maintenance mode should be accessed by only qualified person. 1. To go to maintenance menu press ENTER key. 2. To return top menu press DOWN key.	The initial screen of the system is displayed after approximately 10 seconds of the appearance of checkers. At this time, push RIGHT key with LEFT key being pushed together to display the screen as left. Push ENTER key to go to maintenance menu. Push DOWN key to return to the previous page.
5	▶ Cal. Value 10 Store Mode Maximum System Reset Return Probe Offset 9 Print Density 7 Outline Mode On Calibration Return Exit	Push ENTER key from the screen 4 above to display maintenance menu as left. *) Key manipulation Use up/down key to move menu items from the menu. ▶ appears beside the current menu item. To replace the item value, push ENTER key while the ▶ is still displayed for the corresponding item. To change the item value, scroll until the desired value appears by using left/right value and push ENTER key. *) Refer to the table below for the details.

6	Check ID OK!!! Erase Sector OK!!! Blank Check OK!!! Program OK!!! Verify OK!!! Programming is completed!!!	When the set-up is done, push LEFT key with ENTER key being pushed and then push PRINT key to display the initial screen without having the checkers during rebooting. At this time, the information as left is displayed on the screen. And then turn the system off.

The system variables of Maintenance mode have the following meanings.

<table>
<tr><th>Item</th><th>Contents</th></tr>
<tr><td>Cal. Value</td><td>Change the threshold value. Value range is from 5 to 20.
This value is changed during calibration process.</td></tr>
<tr><td>Store Mode</td><td>Appoints which one to store from the current session. In case of current, the last scanned value is stored. And in case of maximum, the image data with maximum volume is stored.</td></tr>
<tr><td>System Reset</td><td>Reset values of system variables to default.
The default values are as below.
<table>
<tr><th>Menu</th><th>Item</th><th>Reset Value</th></tr>
<tr><td rowspan="5">Maintenance</td><td>Cal. Value</td><td>10</td></tr>
<tr><td>Store Mode</td><td>Maximum</td></tr>
<tr><td>Probe Offset</td><td>9</td></tr>
<tr><td>Print Density</td><td>7</td></tr>
<tr><td>Outline Mode</td><td>On</td></tr>
<tr><td rowspan="5">Setup</td><td>Print Option</td><td>Raw Image</td></tr>
<tr><td>Flash Store</td><td>On</td></tr>
<tr><td>Scan Result</td><td>B-Mode</td></tr>
<tr><td>Auto Power</td><td>5 minute</td></tr>
<tr><td>Prescan Enable</td><td>On</td></tr>
</table></td></tr>
<tr><td>Probe Offset</td><td>Set the initial position of the transducer in the probe. Range is from 3 to 12.
This value is set during calibration process.</td></tr>
<tr><td>Print Density</td><td>Adjusts the density of the print out. The adjustable value ranges from 3 to 10.</td></tr>
<tr><td>Outline Mode</td><td>On / Off control
To control whether the edge information of the bladder is displayed or not on the screen with ultrasound image.
On : The edge information will be displayed.</td></tr>
<tr><td>Exit</td><td>Returns to the previous screen in Maintenance menu.</td></tr>
</table>

8. Calibration Procedures

8.1 Purpose

This procedure is prepared for guidance on the calibration of the BioCon-500. After fully understanding of this procedure, do the calibration.

8.2 Scope

This procedure covers preparations & procedures for needed to calibrate the BioCon-500 using CalKit, CubeScan Phantom, or Dansk Phantom.

8.3 Supported Firmware Version

- Version 3.10pt, Version 3.10pto, Version 3.10apt
- Version 2.61pt, Version 2.61pto, Version 2.61apt

8.4 General

- ***CalKit calibration should be done in a normal mode (not in a maintenance mode).***

- CubeScan phantom calibration and Dansk phantom calibration should be done in a maintenance mode. There is no way to do CubeScan phantom calibration and Dansk phantom calibration in a normal mode.

- There is no limit in using even though the calibration time is elapsed since last calibration currently. But this policy can be changed without prior notice.

- Do not mix up the calibration menu and the tool used in a calibration.

- Normal mode vs. Maintenance mode. You can switch two modes using the combined key **'ENTER+LEFT+PRINT'**. In a maintenance mode the message "MAINTENANCE MODE" is displayed in the Top Screen.

- Calibration necessity

Item	When	Remark
1	When you upgraded BioCon-500's program over Version 3.10	Necessary
2	After replacing Analog Board	Necessary
3	After replacing Digital Board	Necessary
4	After replacing Probe	Necessary
5	Periodical check (Once a year)	Recommended

8.5 Procedures

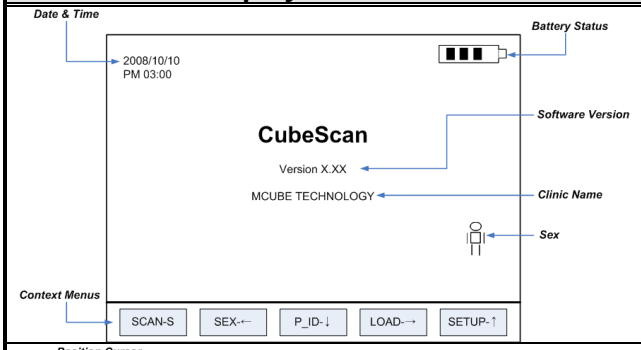
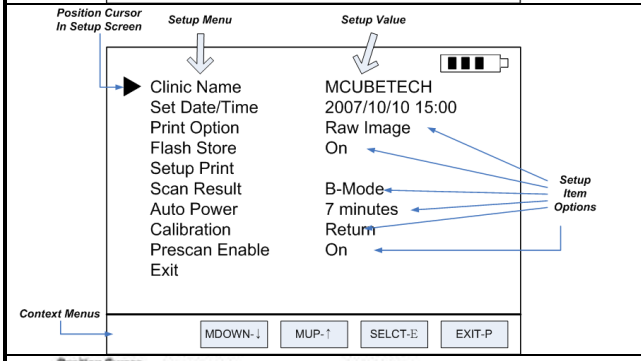
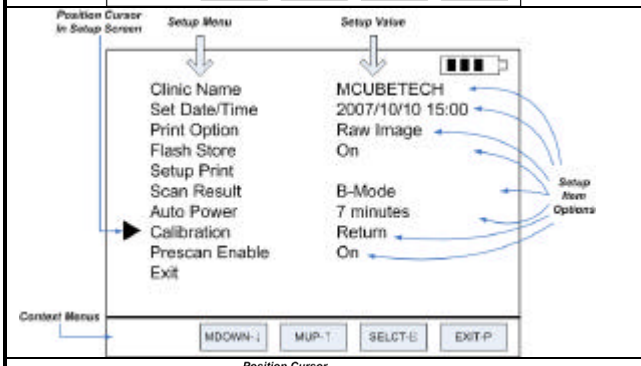
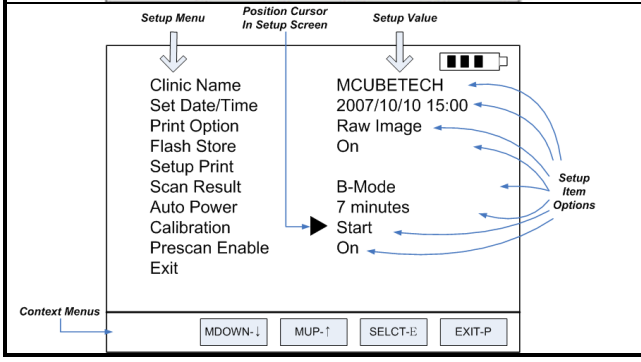
8.5.1 CalKit calibration

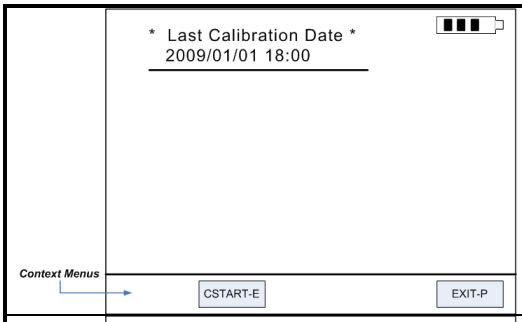
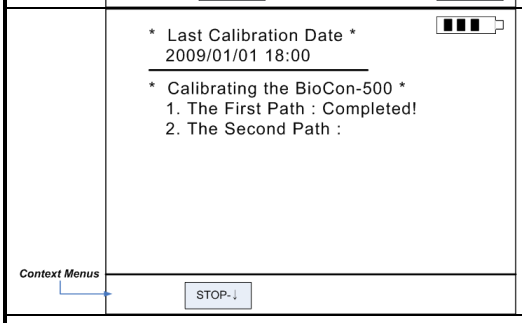
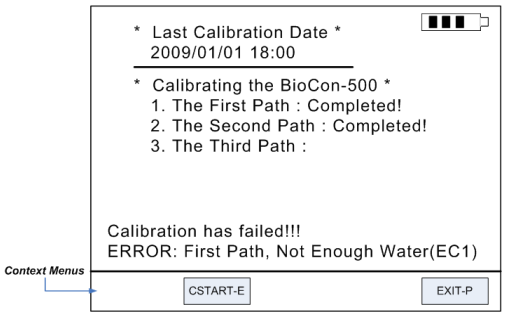
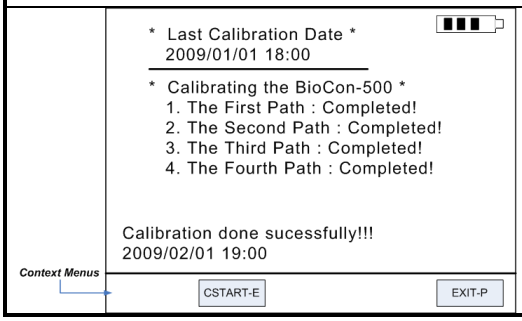
8.5.1.1 Preparing the CalKit

No.	Figure	Description
1		Open the cap of the calibration kit and pour ***saline solution*** up to the fill-mark of the calibration kit. Confirm that the air bubble is absent. You can also the pure water on behalf of the saline solution. But in this case, do calibration after confirming that all the air bubbles went away.
2		Close the cap of the calibration kit.
3		Align the probe scan button with the arrow mark of the calibration kit, and put the probe into the probe holder firmly.

8.5.1.2 Calibrating the BioCon-500 with the calibration kit (CalKit)

1) Connect the probe which is put into the probe holder of the calibration kit.
2) Turn on the BioCon-500
3) Check if the BioCon-500 is in a normal mode.

Screen Display in the BioCon-500	Description
	The Top Screen. Press **UP** key to go to setup menu. ***Check that the system is in a normal mode.***
	Setup Menu Go to “Calibration” setup using **UP** or **DOWN** key.
	Press **ENTER** key.
	Display the “Start” setup value using **LEFT** key or **RIGHT** key.

	Calibration top screen To start calibration, press **ENTER** key.
	Screen during calibration. To stop calibration, press **DOWN** key in the first path or second path. In the third path and fourth path, a user cannot stop the calibration.
	When there is any error during calibration, the system displays the following message in the bottom part of the LCD screen. "Calibration has failed!!!" "ERROR: First Path, Not Enough Water (EC1)". In the error message, "First Path" means the calibration steps when the system detected any error during calibration. "Not Enough Water" means additive information about the error state. This additive information is displayed for only EC1 error. "EC1" means the error code during calibration.
	The screen when the calibration is done successfully. The date and time when the calibration is done successfully is displayed in the bottom part of the LCD screen.

IMPORTANT:

- The BioCon-500 returns to the top screen when calibration process is terminated or stopped.
- To stop the calibration menu, press the down key (only effective in the first and second path of the calibration

process) more than 5 seconds or turn of the system by pressing the power key.

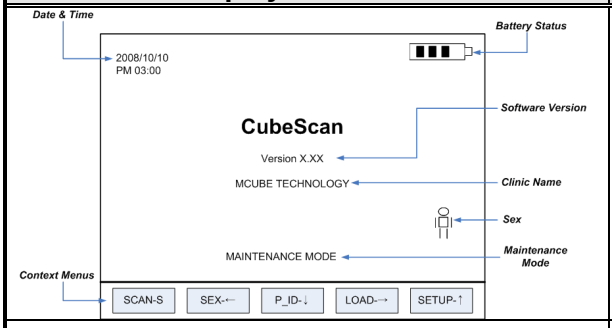
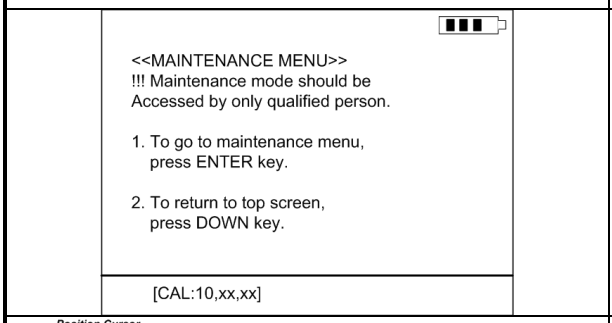
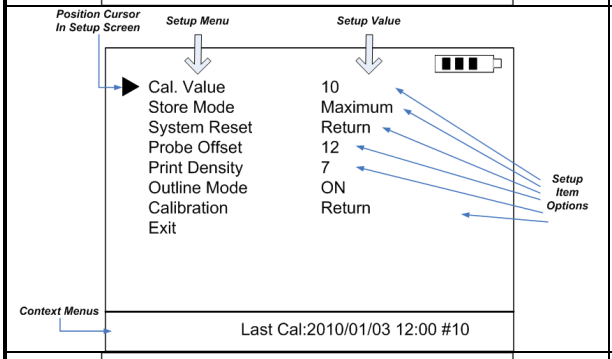
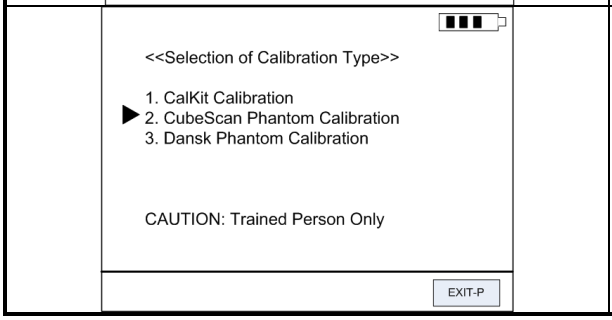
8.5.2 CubeScan Phantom Calibration

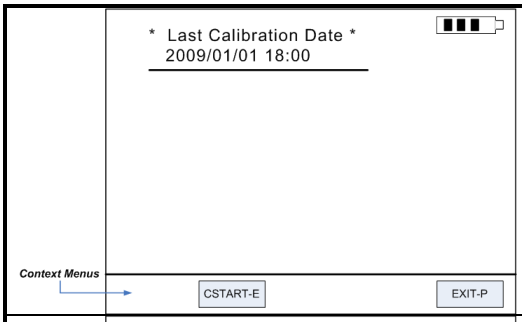
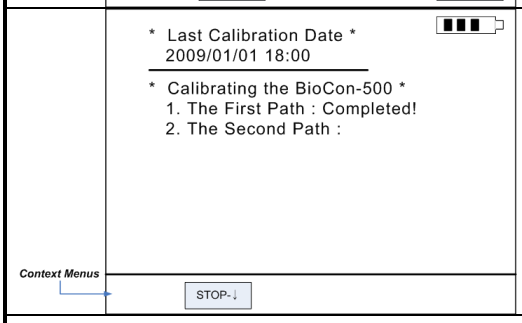
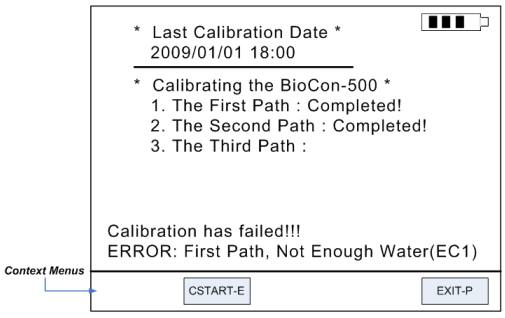
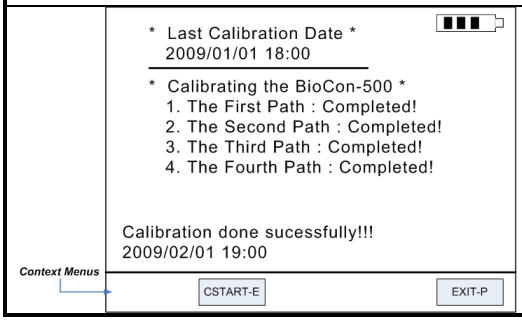
8.5.2.1 Preparing the CubeScan phantom

No.	Figure	Description
1		Place the CubeScan phantom on a flat surface. And open the cover of the phantom.
2		Drop about 5ml water to the center surface of the phantom.
3		Place the holder on the top of the Cubescan phantom. Check if the holder is in a stable and flat position.
4		Put the probe into the probe holder.

8.5.2.2 Calibrating the BioCon-500 with the CubeScan Phantom

1) Connect the probe which is put into the probe holder of the CubeScan phantom.
2) Turn on the BioCon-500
3) Check if the BioCon-500 is in a maintenance mode.

Screen Display in the BioCon-500	Description
	The Top Screen. Press **UP** key to go to setup menu. ***Check that the system is in a maintenance mode.***
-	Press “LEFT+RIGHT” key.
	Maintenance Top Screen Press ENTER key.
	Maintenance Setup Menu 1. Go to “Calibration” setup using **UP** or **DOWN** key. 2. Press **ENTER** key. 3. Display the “Start” setup value using **LEFT** key or **RIGHT** key.
	Maintenance Calibration Top screen Select CubeScan Phantom Calibration using **UP** or **DOWN** key and press **ENTER** key.

	To start calibration, press **ENTER** key.
	Screen during calibration. To stop calibration, press **DOWN** key in the first path or second path. In the third path and fourth path, a user cannot stop the calibration.
	When there is any error during calibration, the system displays the following message in the bottom part of the LCD screen. “Calibration has failed!!!” “ERROR: First Path(EC3)”. In the error message, “First Path” means the calibration steps when the system detected any error during calibration. “EC3” means the error code during calibration.
	The screen when the calibration is done successfully. The date and time when the calibration is done successfully is displayed in the bottom part of the LCD screen.

IMPORTANT:

- The BioCon-500 returns to the top screen when calibration process is terminated or stopped.
- To stop the calibration menu, press the down key (only effective in the first and second path of the calibration process) more than 5 seconds or turn of the system by pressing the power key.

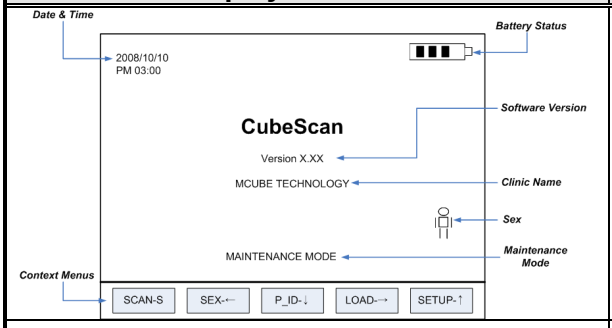
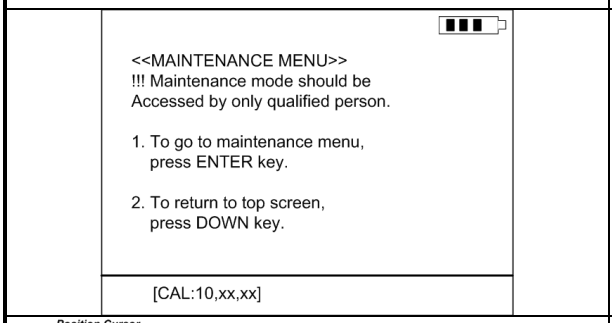
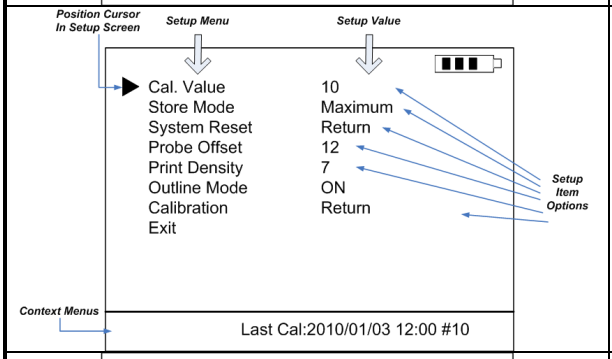
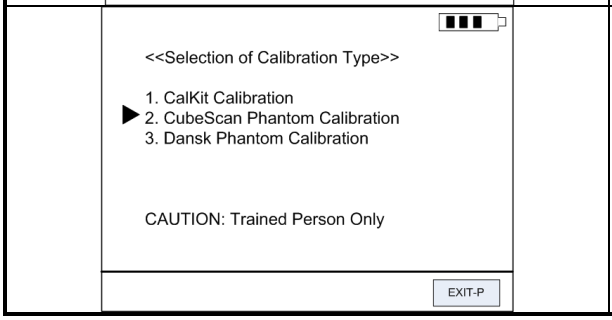
8.5.3 Dansk Phantom Calibration

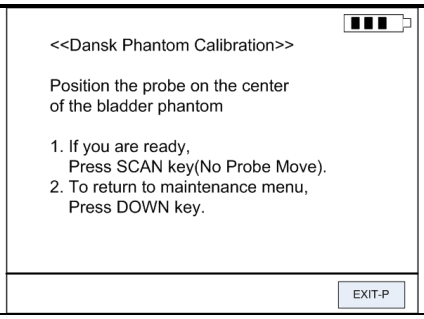
8.5.3.1 Preparing the Dansk phantom

No.	Figure	Description
1		Place the Dansk phantom on a flat surface. And open the cover of the phantom. Pour water to the center surface of the phantom.
2		Place the holder on the top of the Dansk phantom. Check if the holder is in a stable and flat position.
3		Put the probe into the probe holder.

8.5.3.2 Calibrating the BioCon-500 with the Dansk Phantom

1) Connect the probe which is put into the probe holder of the CubeScan phantom.
2) Turn on the BioCon-500
3) Check if the BioCon-500 is in a maintenance mode.

Screen Display in the BioCon-500	Description
	The Top Screen. Press **UP** key to go to setup menu. ***Check that the system is in a maintenance mode.***
-	Press “LEFT+RIGHT” key.
	Maintenance Top Screen Press ENTER key.
	Maintenance Setup Menu 1. Go to “Calibration” setup using **UP** or **DOWN** key. 2. Press **ENTER** key. 3. Display the “Start” setup value using **LEFT** key or **RIGHT** key.
	Maintenance Calibration Top screen Select ***Dansk*** Phantom Calibration using **UP** or **DOWN** key and press **ENTER** key.

	To start calibration, press **SCAN** key.
	After completion of the calibration following message will be displayed on the bottom of the LCD screen. “Calibration is completed!!!” In case of failure following message will be displayed on the bottom of the LCD screen. "Calibration is failed"

8.5.3.3 Full calibration procedures using Dansk phantom

Step	Description
1	Turn the system on in MAINTENANCE mode.
2	Go to maintenance top screen using “LEFT+RIGHT” key in a Top Screen.
3	Press ENTER key to go to the maintenance setup screen.
4	Set Cal. Value to 10.
5	Set Probe Offset to 6.
6	Set Outline mode to ON.
7	Exit from Maintenance Setup Screen and go to the Top Screen.
8	Scan the Dansk bladder phantom.
9	Check the positioning circle.
10	If the image is in the center, go to step 16).
11	Go to the Maintenance Setup Screen. Adjust the value of Probe Offset. (As the value of probe offset increases, the image goes down to the circle and the value would be proper between 5 to 10(the range between 3 ~ 12).->setting probe offset
12	Exit from Maintenance Setup Screen and go to the Top Screen.
13	Go to step 8)
14	Do Dansk phantom calibration according to 5.2.2 (3~4times)
15	Exit from Maintenance Setup Screen and go to the Top Screen.
16	If the CAL. Value is < 8 or >13, after changing R43 in analog board, go to step 1). (**You must get the proper instruction from the Headquarter when you replace the R43.)
17	Scan the bladder phantom.
18	Check the calculated volume if the volume ranges from 119 to 145. Then fine.

19	If the measured volume is beyond the normal value, go to step 1)

8.6. Error Messages during CalKit Calibration and CubeScan Phantom Calibration

Error Code	Description	Remark
1	Insufficiency of saline solution	Check the solution level.
2	Transducer error	Check the transducer Check probe connection
3	Plane motor error(1)	Check the plane motor Check probe connection
4	Plane motor error(2)	Check the plane motor Check probe connection
5	Reserved	
6	Reserved	
7	Error in the Analog Board	Check the Analog Board
8	If there's no reflection signal from target.	Probe is not in the CalKit.
9	Angle Motor Error(1)	Check the angle motor Check probe connection
10	Angle Motor Error(2)	Check the angle motor Check probe connection
11	Distance error from transducer to target	Frame – out of position
12	Too low echo signal	Confirm that the air bubble is absent. Check the Analog Board
13	Too high echo signal	Check the Analog Board
14	Reserved	
15	Measured volume value is different reference value.	(Phantom calibration only)
16	Scan data transmission error	Check the Control Board (Phantom calibration only)
17	Error in detection of bladder phantom sides.	(Phantom calibration only)
18	Reserved	

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CUBEscan

BioCon-500™

Bladder Volume Measurement System

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MUM-BioCon 500(Rev. 2.1)